

# **SDMS US EPA REGION V -1**

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HYDROGEOLOGIC INVESTIGATION  
OUTBOARD MARINE CORPORATION  
WAUKEGAN, ILLINOIS

C 8342

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**WARZYN**  
  
**ENGINEERING INC**

Consulting Engineers • Civil • Structural • Geotechnical • Materials Testing • Soil Borings • Surveying

1409 EMIL STREET, P.O. BOX 8538, MADISON, WIS. 53716 • TEL (608) 257-4848

September 20, 1979  
C 8342

JRB Associates  
8400 West Park Drive  
McLean, VA 22101

Attention: Mr. Ed Saltzberg

Re: Hydrogeologic Investigation  
Outboard Marine Corporation  
Waukegan, Illinois

Gentlemen:

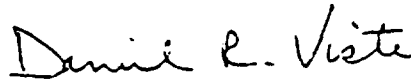
We are pleased to submit the results of our hydrogeologic investigation performed at the Outboard Marine Corporation property in Waukegan, Illinois. We have included two copies of this report for your review.

All work tasks as outlined in the scope of our proposal dated March 29, 1979 have been completed. In addition, the report contains photo documentation of contamination prevention methods used during the subsurface exploration program as well as pertinent maps, drawings and tables that present the hydrogeological data.

If you have any questions or comments, please contact us.

Very truly yours,

WARZYN ENGINEERING INC.



Daniel R. Viste, Chief Hydrogeologist  
Project Manager

DRV/dmf

Encl: Report (2)

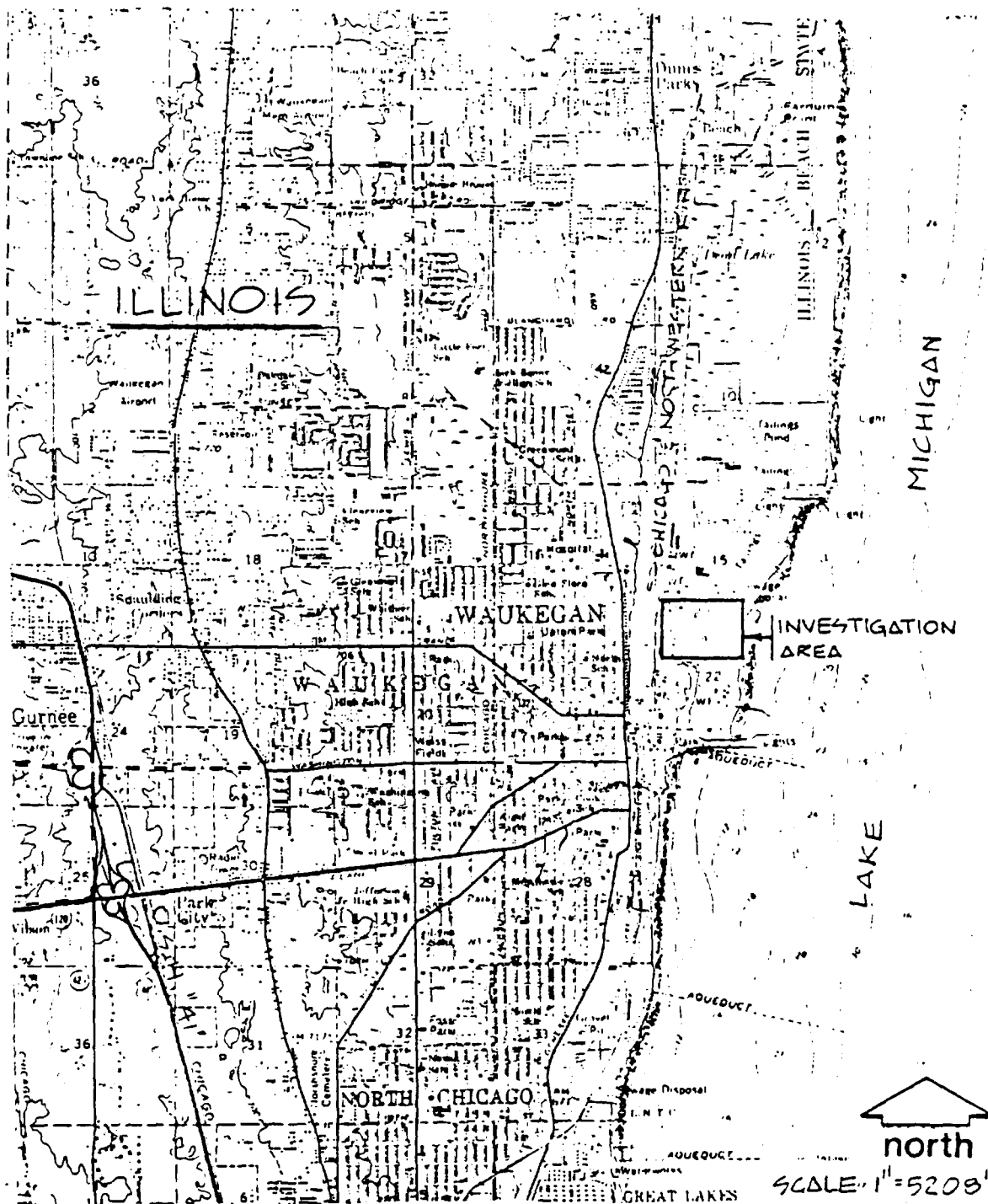
HYDROGEOLOGIC INVESTIGATION  
OUTBOARD MARINE CORPORATION  
WAUKEGAN, ILLINOIS

INTRODUCTION

The results of the hydrogeologic investigation performed at and near the Outboard Marine Corporation-Johnson Division plant (OMC) property in Waukegan, Illinois (See Drawing C 8342-A1) are presented in the following report. The investigated area is located in portions of the SW 1/4 and SE 1/4, Section 15 and the NW 1/4, Section 22, Township 45 North, Range 23 East, Lake County, Illinois. The site is bounded on the east by Lake Michigan, on the south by Waukegan Harbor, on the west by the Chicago and Northwestern Railroad tracks and on the north by the Northshore Sanitary District property.

The study was initiated by the Environmental Protection Agency, Region V, as a result of previous disposal of industrial related waste (PCB) by OMC into a drainage channel which discharges into Lake Michigan. This study was performed under contract to JRB and Associates of McLean, Virginia. The scope of services provided by Warzyn were outlined in a proposal to JRB and Associates, dated March 29, 1979.

The work elements of the hydrogeologic investigation at the site included the completion of 15 soil borings, collection and field classification of soil samples, instrumentation of the borings as groundwater monitoring wells, baildown permeability tests, water level measurements, surveying, and



NOTE: MAP DEVELOPED BY ALTERING U.S.G.S. 15 MIN. QUADRANGLE MAP; WAUKEGAN, ILL., 1960.

\* INVESTIGATION AREA OUTLINES PHOTO AREA SHOWN ON DRAWING NO. C8342-B1.

**WARZYN**



**ENGINEERING INC**

VICINITY MAP

HYDROGEOLOGIC INVESTIGATION

OUTBOARD MARINE CORPORATION

WAUKEGAN, LAKE COUNTY

ILLINOIS

DWN CMP

CHK'D DWH

APP'D *Daniel R. Viste*

DATE 9/20/77

C8342-A1

a photo documentation of the methods used. In the laboratory, selected soil samples were given physical tests to aid in their classification. Field data collected was analyzed to develop a Site Topography Map (Drawing No. C 8342-B1), a Water Table Map (Drawing No. C 8342-B2), and Geologic Cross Sections (Drawing No. C 8342-B3).

### SUBSURFACE EXPLORATION PROGRAM


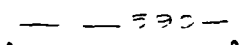



#### A. Introduction

This section discusses the subsurface exploration program at the site and related procedures developed and implemented to minimize potential contamination of the wells. Many of these procedures are illustrated through photo documentation attached as Appendix F.

#### B. Discussion of Exploration Program


Fifteen soil borings were performed at the site at 9 locations between July 17, and July 27, 1979 (see Drawing C 8342-B2), using a truck mounted, CME 55 rotary drill rig. A standard penetration boring was performed at each of the 9 locations, and two additional earth borings were performed at Locations 2, 4 and 7, see Appendices A and B. Soil samples collected from the standard penetration borings were visually classified in the field and later reclassified in the laboratory to the Unified Soil Classification System. Logs of the soil borings appear in Appendix C.

# LEGEND

-  DENOTES SPOT ELEVATION  
 TOPOGRAPHIC CONTOUR (2 FT. CONTOUR INTERVAL)  
 GEOLOGIC CROSS-SECTION LOCATION  
 W2 WATER TABLE WELL LOCATION  
 W2 A,B,C PIEZOMETER NEST LOCATION

# NOTES

- 1) BASE MAP EXPANDED FROM 1:12000 AERIAL PHOTOGRAPH NO. LNZ-RN1-7947-16, DATED 5-02-73, SUPPLIED BY EPA REGION II OFFICE.
- 2) TOPOGRAPHIC AND MONITORING WELL CONTROL SURVEY PERFORMED BY WARZYN ENGINEERING INC., AUGUST 13-15, 1979.
- 3) PIEZOMETER NESTS W2, W4, AND W7 EACH CONTAIN ONE WATER TABLE WELL (A) AND TWO PIEZOMETERS (B,C).
- 4) GEOLOGIC CROSS-SECTIONS ARE SHOWN ON DRAWING C8342-33
- 5) TOPOGRAPHIC ELEVATIONS ARE BASED ON U.S.G.S. DATUM (M.S.L.). ADD 500 FEET TO SPOT ELEVATIONS TO OBTAIN U.S.G.S. DATUM.

SITE TOPOGRAPHY AND WELL LOCATIONS			
HYDROGEOLOGIC INVESTIGATION OUTBOARD MARINE CORPORATION			
WAUKEGAN		LAKE COUNTY	ILLINOIS
<b>WARZYN</b>  ENGINEERING INC	DRAWN CMP	SCALE 1" = 300'	SHEET 1 OF 3
	CHECKED DWH	DATE 9/20/79	DRAWING NO.
	APPROVED <i>Samuel R. White</i>	C 8342-B1	
	REFERENCE	PRINTED DEC 7 1979	

All 15 soil borings were instrumented as groundwater monitoring wells to facilitate the measurement of groundwater levels and the collection of groundwater samples for chemical analysis. One water table well was installed at each of the 9 locations, while two additional piezometers were installed at Locations 2, 4 and 7. Well construction information is presented in Appendix C.

The water table wells were constructed with 1 1/4" ID Type 304 stainless steel pipe attached to 1 1/4" ID 5' stainless steel well screens with stainless steel couplings. The top of the well screen was set at or near the water table at each water table well installation.

The piezometers at Locations 2, 4 and 7 were installed for the purposes of determining vertical gradients in the groundwater flow system and for groundwater quality monitoring with depth in the groundwater system. The piezometers were constructed of 1 1/4" ID stainless steel pipe attached to a 1 1/4" ID 2' stainless steel well screen and sealed at a prescribed depth. At each nest of wells, the shallow and deep piezometers were installed such that the tops of their well screens were near 15 and 25' below water table, respectively.

#### C. Contamination Prevention Procedures

The nature of this investigation necessitated clean working areas at the bore hole sites to minimize potential contamination of the wells during the soil boring, soil sampling, and well instrumentation procedures. Special procedures were developed to specifically limit:

1. PCB contamination from hydraulic fluid and other petroleum products associated with the drilling rig and soil boring procedures,
2. PCB contamination from cutting oils used to cut and thread the stainless steel pipe, couplings and points, and
3. Inter- and intra-bore hole contamination due to PCB's (hydraulic fluids) encountered during the soil boring and sampling procedures.

Prior to mobilization of the drilling rig to the project site the rig and all of the associated drilling equipment (well casings, augers, drilling bits, tools) were thoroughly steam cleaned to remove as much dirt and grease as possible. In addition, the stainless steel well pipes were initially cleaned inside and out with acetone soaked cloth to remove the cutting oils and grease used to cut and thread the well pipe, which may have contained PCB's. The well pipes were again acetone cleaned later at the project site. The acetone was used as a solvent in the soil boring, soil sampling, and well installation procedures described below as a means of removing grease and oils from equipment on site.

#### 1. Soil Boring Procedures

Except for Boring No. 8, which was simply augered to the proper depth, all other borings were performed by the wash boring method (Photo No. 1). This method requires temporary well casing to be driven into the ground, the soils cut with a rotating bit, and then washed out of the bore hole by circulating drilling water. Drilling water was obtained from the OMC plant. During the boring program, the drilling water was discharged and replaced between borings to effectively limit potential inter-bore hole contamination.

Before drilling of the first bore hole (No. 8), the augers were spray cleaned at the site with acetone. Before the first wash boring the well casing, drill rod, casing drive weight, and bits were initially sprayed with acetone. Between boring locations, these items were hosed off and cleaned with bristle brushes with clean plant water (Photo No. 2). These items were occasionally recleaned with acetone when necessary.

The acetone was sprayed onto the equipment with a "Hudson" pressurized canister sprayer (Photo No. 3). In addition to the drilling equipment, gloves and tools were also degreased and cleaned with acetone before use. These items were periodically resprayed or replaced as necessary. As a rule, plastic sheeting was placed near the working area, on which all clean tools and drilling equipment were cleaned and stored.

Special attention was given to the threads on the well casing and drill rod. Ordinarily, these are lubricated with oils so that the threads of the male and female couple will not bind. Since lubricating oils may contain PCB, a silicone based grease called "Molykote No. 33" was used as a lubricant in place of the oil (Photo No. 4). The silicone grease does not contain PCB.

## 2. Soil Sampling Procedure

Soil samples were collected by the split spoon method at each boring location. At Locations 2, 4 and 7, where nests of three wells were installed, split spoon samples were collected only from the deepest boring.

The split spoon apparatus was carefully brushed with water and acetone between each sample collected (Photo No. 5). The water wash was performed in acetone rinsed galvanized buckets which, in turn, were periodically cleaned. The acetone was usually applied directly to the split spoon or the sprayer after the water wash and allowed to evaporate. This multi-purpose cleaning procedure limited:

1. Potential down-hole contamination by PCB's that might have remained on the split spoon sampler from a previous sample had it not otherwise been cleaned,
2. Potential intra-hole contamination, and
3. Contamination of selected soil samples collected by EPA personnel for chemical analysis.

### 3. Well Installation Procedures

After the bore holes were advanced to the proper depth, they were instrumented as groundwater monitoring wells. At each well installation, the well pipe, couplings and well points were again cleaned with acetone.

The stainless steel pipes were cleaned by inserting an acetone soaked cloth attached to the end of a bamboo pole and swabbing the pipes (Photo No. 6). The outside of the pipes were cleaned by spraying directly with acetone and wiping with a clean cloth, or simply wiping with an acetone soaked cloth, acetone evaporates very quickly (Photo No. 7). Again, special attention was given to the threads of the well pipes to remove any cutting oil. The couplings also received similar attention. Well points were also spray cleaned with acetone similar to the pipes (Photo No. 8). The inside and outside of the metal protective casings for the wells were also cleaned by spraying acetone or using acetone soaked cloth (Photo No. 9).

After cleaning all stainless steel parts, the monitoring wells were assembled and placed in the bore hole. The areas around the well points were then backfilled with flint sand to about 1' above the well screens (Photo No. 10). Three-foot bentonite pellet seals were placed above the piezometer well screens at Locations 2, 4 and 7, Wells B and C (Photo No. 11). No bentonite pellet seals were placed above the well point screens in the water table wells. Backfill consisted of flint sand and/or bore hole cave-in material. No spoils material was returned to the bore holes. Three-foot bentonite "Volclay" top seals were placed at the ground surface of each bore hole (Photo No. 12).

After the wells were backfilled, a locking, metal protective casing was set over each well, such that the base of the protective casings were about 2' below the ground surface. A concrete base was then placed around each metal protective casing. Each protective casing was locked and vented. Detailed well construction information for individual wells appears in Appendix C and on Drawing C 8342-B3.

After each installation was complete, the wells were pumped for about 1 hour, using a three horsepower gas driven pump with an attached 0.4" ID hose (Photo No. 14). Before inserting the pump hose into the wells, it was wiped clean to avoid contributing contamination to the wells. The wells were developed and cleaned by pumping to minimize silting and aid in the removal of potential contaminants.

Extraordinary care was used in the implementation of the procedures described above. The photo documentation provides some insight into the preventive methodology used in the subsurface exploration program. Additional photos are available which document in great detail the procedures used in the program.



# LEGEND

- WATER TABLE CONTOUR (1 FT. CONTOUR INTERVAL)
- INFERRED WATER TABLE CONTOUR
- DIRECTION OF GROUNDWATER FLOW
- TOPOGRAPHIC CONTOUR (2 FT. CONTOUR INTERVAL)
- WATER TABLE WELL LOCATION
- PIEZOMETER NEST LOCATION
- STAFF GAGE LOCATION

## NOTES

- 1) WATER TABLE CONTOURS AND SURFACE WATER ELEVATIONS BASED ON DATA COLLECTED AUGUST 14, 1979.
- 2) BASE MAP EXPANDED FROM 1:12000 AERIAL PHOTOGRAPH NO. LN2-RN1-7847-16, DATED 5-02-78, SUPPLIED BY EPA REGION V OFFICE.
- 3) THE STAFF GAGE LOCATIONS SUPPLIED BY U.S. GEOLOGICAL SURVEY.
- 4) TOPOGRAPHIC AND MONITORING WELL CONTROL SURVEY PERFORMED BY WARZYN ENGINEERING INC., AUGUST 13-15, 1979.
- 5) PIEZOMETER NESTS W2, W4 AND W7 EACH CONTAIN ONE WATER TABLE WELL (A) AND TWO PIEZOMETERS (B, C).

WATER TABLE MAP			
HYDROGEOLOGIC INVESTIGATION OUTBOARD MARINE CORPORATION			
WAUKEGAN	LAKE COUNTY	ILLINOIS	
<p><b>WARZYN</b> ENGINEERING INC</p>	DRAWN CMP	SCALE 1" = 300'	SHEET 2 OF 3
	CHECKED DWH	DATE 9/20/79	DRAWING NO.
	APPROVED <i>Daniel R. Vige</i>		C 8342-B2
	REFERENCE		PRINTED DEC 7 1979

## TESTING AND ANALYSIS

### A. Field Baildown Tests

Baildown tests were performed on the installed wells to determine soil permeabilities. The baildown tests consisted of pumping down the water level inside each well with a three horsepower gas driven pump and subsequently measuring the recovery of the water level to static water level over time. Depth to water was measured in the wells during the test with a fiberglass measuring tape with an attached "sounder". The time that lapsed during the test was recorded on a stopwatch (Photo No. 14). The results of the baildown permeability tests are presented in Table 1. Additional data and methods of reduction are included in Appendix D.

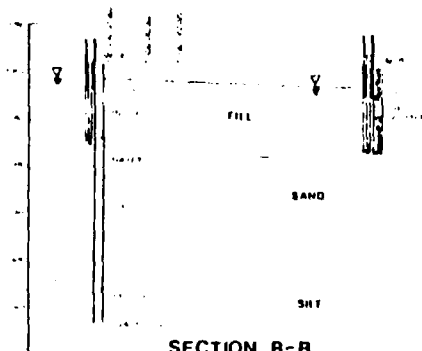
### B. Groundwater Level Measurements

Water level measurements obtained from the installed groundwater monitoring wells appear in Table 2. Water level measurements were taken from the top of either the stainless steel well pipe or the metal protective casing, whichever was higher at a specific well. Both the well pipe and the protective casing tops were surveyed for elevation.

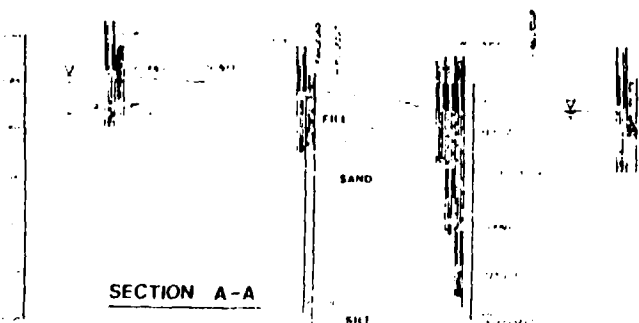
The groundwater elevation measurements collected from the water table wells at the project site were used to construct a water table map, as presented on Drawing C 8342-82. Measurements of groundwater levels within Piezometer Nests 2, 4 and 7 at the site allow the calculation of vertical gradients at each nest.



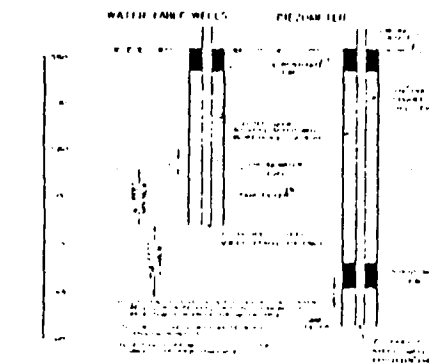
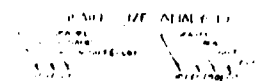
**SECTION C-C**



**SECTION B-B**



**SECTION A-A**



Legend


- WATER TABLE
- WATER TABLE WELLS
- PIEZOMETER
- WATER TABLE
- WATER TABLE

# NOTES

- 1) WATER LEVEL MEASUREMENTS OBTAINED ON 8/14/79.
- 2) THE GEOLOGIC CROSS-SECTIONS ARE GENERAL IN NATURE AND DO NOT PURPORT TO BE AN EXACT REPRESENTATION OF SUBSOIL CONDITIONS BETWEEN INDIVIDUAL BORINGS.
- 3) CROSS-SECTION LOCATIONS SHOWN ON DRAWING C8342-B1.

## SCALE

HORIZONTAL - 1" = 300'  
VERTICAL - NONE

GEOLOGIC CROSS-SECTIONS			
HYDROGEOLOGIC INVESTIGATION OUTBOARD MARINE CORPORATION			
WAUKEGAN		LAKE COUNTY	
		ILLINOIS	
 ENGINEERING INC	DRAWN CMP	SCALE AS SHOWN	SHEET 3 OF 3
	CHECKED D'WH	DATE 9/20/79	DRAWING NO. C8342-B3
	APPROVED <i>Daniel R. Vieto</i>		
	REFERENCE		PRINTED DEC 7 1979

### C. Surface Water Measurements

U.S. Geological Survey staff gage locations along the drainage ditch are shown on Drawing C 8342-B2. Although the staff gages were not read as part of the in-field investigation, the elevation datum (msl) of each gage was determined and is listed for future use in Table 4. In addition, USGS staff gage readings from August 17, 1979 are presented.

Surface water bodies were located and elevations obtained as part of the August 13-15, 1979 topographic survey at the site. The surface water elevations were used in part to construct the water table map, Drawing C 8342-B2. This data indicates little change in water levels between staff gage 78 (581.70' msl) and the west end of the main ditch (581.84' msl).

### D. Soil Laboratory Testing

Soil samples obtained during the subsurface exploration program were visually classified by a staff hydrogeologist and selected samples were subjected to physical tests to aid in classifying according to the Unified Soil Classification System. Physical testing on the samples include grain size analyses (washed sieve and hydrometer testing) and Atterberg limits where applicable. The results are presented on Drawings C 8342-A2 through -A7 (Appendix E) and Table 3.

Geologic cross sections through the site are presented on Drawing C 8342-B3. The cross section locations are shown on Drawing C 8342-B1. The sections show the relationship between topography, surface water, soil types, and groundwater at the site.

E. Field Surveying

A survey crew was on-site August 13 through 15, 1979 to collect elevation and location data regarding site topography and well locations. The topographic survey was performed by transit stadia methods resulting in an accuracy of 0.1' vertical for ground shots and 1.0' horizontal (location) position. The resulting topographic map is presented as Drawing C 8342-B1.

Differential levels were run on all well casings to a tolerance of 0.01'. The wells were tied to a USGS vertical benchmark at the Waukegan, Illinois, post office with a third order closure accuracy. Elevations of the ground surface, top of well pipe, top of metal protective casings, and depth of well for each well installation are presented in Table 2.

CLOSING REMARKS

We trust that this report and the information contained herein is sufficient for your present needs. The hydrogeologic investigation was completed within the framework of our March 29, 1979 proposal and associated, additional tasks as requested. If you have any questions or desire further elaboration, please contact us.

Respectfully submitted,

WARZYN ENGINEERING INC.

*Daniel W. Hall*

Daniel W. Hall  
Hydrogeologist

*Daniel R. Viste*

Daniel R. Viste, Chief Hydrogeologist  
Project Manager

DWH/DRV/dmf



TABLE 2 Summary of Groundwater Elevations (Cont.)

Well No.	Elevation of Ground Surface	Elevation of Top of Well	Elevation of Protective Casing	Well Depth	AUGUST 14, 1979	
					Depth to Water <sup>a</sup>	Water Elevation
1	584.6	586.37	587.66	8.7	5.11	582.55
2A	583.1	584.98	585.31	8.6	3.52	581.79
2B	583.2	585.83	586.00	19.9	4.17	581.83
2C	583.1	586.28	586.49	31.8	4.58	581.91
3	589.8	593.25	593.38	11.9	10.32	583.06
4A	584.0	585.93	586.22	8.6	4.30	581.92
4B	583.9	586.80	586.74	19.6	4.88	581.92
4C	583.9	587.23	587.43	26.6	5.52	581.91
5	585.5	586.98	588.88	9.0	5.42	583.46
6	585.6	589.01	588.92	9.6	6.87	582.14
7A	585.0	586.92	587.45	8.6	5.35	582.10
7B	584.8	587.36	587.75	15.9	5.67	582.08
7C	584.9	587.34	588.01	22.6	5.93	582.08
8	588.9	590.68	591.25	8.7	5.61	585.64
9	586.3	588.21	588.84	8.6	4.56	584.28

<sup>a</sup> Measured from Highest Point on Protective Casing or Stainless Steel Well Pipe, Whichever is Higher.

NOTE: All Elevations Relative to Mean Sea Level.

SUMMARY OF GROUNDWATER ELEVATION

<u>WELL NO.</u>	<u>August 14, 1979</u>	<u>August 30, 1979</u>	<u>September 5, 1979</u>	<u>September 11, 1979</u>
1	582.55	582.61	582.18	582.26
2A	581.79	581.45	581.58	582.87
2B	581.83	581.44	581.76	582.84
2C	581.91	581.48	581.76	582.86
3	583.06	583.00	581.89	582.98
4A	581.92	581.65	581.82	582.95
4B	581.92	581.61	581.90	582.98
4C	581.91	581.60	581.79	582.94
5	583.46	585.59	585.07	583.38
6	582.14	581.99	582.03	582.55
7A	582.10	582.14	582.12	583.01
7B	582.08	582.17	582.11	582.98
7C	582.08	582.14	582.04	583.00
8	585.64	585.39	587.06	586.18
9	584.28	584.89	585.18	584.03

\* Data collected and supplied by U.S. EPA personnel.

WAUKEGAN 8342

TABLE 3 Summary of Soil Characteristics

Boring No.	Sample No.	Depth (Ft)	Liquid Limit	Plastic Limit	Plastic Index	% Gravel	% Sand	% P200	% Silt	% Clay	USCS Soil Type
1	2	5				11	84	5			SP-SM
2C	2	5				0	96	4			SP
2C	6	20				0	89	11			SP-SM
2C	9	35	20.2	18.9	1.3	0	2	98	77	21	ML
3	4	10				0	96	4			SP
4C	2	5				34	61	5			SP-SM
4C	5	15				1	89	10			SP-SM
4C	8	30	20.5	18.4	2.1	0	0	99	85	15	ML
5	2	5				2	94	4			SP
6	3	7.5				0	97	3			SP
7C	2	5				1	97	2			SP
7C	5	15				0	88	12			SM
7C	6	20				2	81	17			SM
7C	7	25	16.3	12.6	3.7	3	25	72	52	20	ML
8	1	2.5				45	43	12			SW-SM
9	2	5				11	66	23			SM

T. LE 3 Summary of Soil Characteristics (Cont.)

Boring No.	Sample No.	Depth (Ft)	Liquid Limit	Plastic Limit	Plastic Index	% Gravel	% Sand	% P200	% Silt	% Clay	USCS Soil Type
9	4	10				4	87	9			SP-SM
9	8	27.5	21.2	16.2	5.0	0	4	96	70	26	ML-CL

TABLE 4  
STAFF GAGE DATA FROM OMC DRAINAGE DITCH

August 17, 1979

<u>STAFF GAGE NUMBER</u>	<u>DATUM FT. MSL</u>	<u>GAGE READING</u>	<u>SURFACE WATER* ELEVATION</u>
78	582.35	2.20	582.35
1745	582.41	1.34	582.41
1810	582.41	1.34	582.41
2117	582.43	1.33	582.43
2567	582.48	0.68	582.48

Source: U.S. Geological Survey

\* Note: Surveyed water elevations by Warzyn Engineering Inc., on August 14, 1979 581.70 at Sta. 78 and 581.84 at the west end of main ditch near Sta. 1745.

APPENDIX A

Subsurface Investigation, General Remarks

## APPENDIX "A"

### Subsurface Investigation

#### GENERAL REMARKS

We have endeavored to evaluate subsurface conditions and physical properties of the subsoil as revealed by the borings and laboratory testing. A problem inherent in this evaluation is the variability in engineering properties within soil strata involved, and specifically in any location variation in the soil which is located between borings. Due to natural or man-made causes, subsurface conditions may change with time.

Conclusions drawn and recommendations given in this report are for a specific proposed use of this site. They are our opinions and are based upon conditions that existed at the boring locations and such parameters as proposed site usage, soil loading, elevations, etc..

Since subsurface conditions depend on seasonal moisture variations, frost action, construction methods, and the inherent natural variations, careful observations must be made during construction. These should be brought to our attention as it may be necessary to modify the conclusions and recommendations presented herein.

APPENDIX B

Field Methods for Exploration and Sampling Soils

## APPENDIX "B"

### FIELD METHODS for EXPLORATION AND SAMPLING SOILS

#### A. Boring Procedures Between Samples

The bore hole is extended downward, between samples, by a continuous flight auger, driven and washed-out casing, or rotary boring with drilling mud or water.

#### B. Standard Penetration Test and Split-Barrel Sampling of Soils (ASTM\* Designation: D 1586)

This method consists of driving a 2" outside diameter split barrel sampler using a 140 pound weight falling freely through a distance of 30 inches. The sampler is first seated 6" into the material to be sampled and then driven 12". The number of blows required to drive the sampler the final 12" is recorded on the log of borings and known as the Standard Penetration Resistance. Recovered samples are first classified as to texture by the driller. Later, in the laboratory the driller's classification is reviewed by a soils engineer who examines each sample.

#### C. Thin-walled Tube Sampling of Soils (ASTM\* Designation: D 1587)

This method consists of forcing a 2" or 3" outside diameter thin wall tube by hydraulic or other means into soils, usually cohesive types. Relatively undisturbed samples are recovered.

#### D. Soil Investigation and Sampling by Auger Borings (ASTM\* Designation: D 1452)

This method consists of augering a hole and removing representative soil samples from the auger flight or bucket at 5'0" intervals or with each change in the substrata. Relatively disturbed samples are obtained and its use is therefore limited to situations where it is satisfactory to determine approximate subsurface profile.

#### E. Diamond Core Drilling for Site Investigation (ASTM\* Designation: D 2113)

This method consists of advancing a hole in hard strata by rotating downward a single tube or double tube core barrel equipped with a cutting bit. Diamond, tungsten carbide, or other cutting agents may be used for the bit. Wash water is used to remove the cuttings. Normally a 2" O.D. by 1 3/8" I.D. coring bit is used unless otherwise noted. The rock or hard material recovered within the core barrel is examined in the field and laboratory. Cores are stored in partitioned boxes and the length of recovered material is expressed as a percentage of the actual distance penetrated.

\*American Society for Testing and Materials, Philadelphia, Pennsylvania

APPENDIX C

Soil Boring Logs and Well Construction Details



# UNIFIED SOIL CLASSIFICATION SYSTEM

## COARSE-GRAINED SOILS

than half of material is larger than No. 200 sieve size.)

<b>Clean Gravels</b> (Little or no fines)	
<b>GW</b>	Well-graded gravels, gravel-sand mixtures, little or no fines
<b>GP</b>	Poorly graded gravels, gravel-sand mixtures, little or no fines
<b>Gravels with Fines</b> (Appreciable amount of fines)	
<b>GM<sub>u</sub></b>	Silty gravels, gravel-sand-silt mixtures
<b>GC</b>	Clayey gravels, gravel-sand-clay mixtures

<b>Clean Sands</b> (Little or no fines)	
<b>SW</b>	Well-graded sands, gravelly sands, little or no fines
<b>SP</b>	Poorly graded sands, gravelly sands, little or no fines
<b>Sands with Fines</b> (Appreciable amount of fines)	
<b>SM<sub>u</sub></b>	Silty sands, sand-silt mixtures
<b>SC</b>	Clayey sands, sand-clay mixtures

## FINE-GRAINED SOILS

than half of material is smaller than No. 200 sieve.)

**ML** Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity

**CL** Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays

**OL** Organic silts and organic silty clays of low plasticity

**MH** Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts

**CH** Inorganic clays of high plasticity, fat clays

**OH** Organic clays of medium to high plasticity, organic silts

**PT** Peat and other highly organic soils

## LABORATORY CLASSIFICATION CRITERIA

**GW**  $C_u = \frac{D_{60}}{D_{10}}$  greater than 4;  $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$  between 1 and 3

**GP** Not meeting all gradation requirements for GW

**GM** Atterberg limits below "A" line or P.I. less than 4

**GC** Atterberg limits above "A" line with P.I. greater than 7

Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols

**SW**  $C_u = \frac{D_{60}}{D_{10}}$  greater than 6;  $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$  between 1 and 3

**SP** Not meeting all gradation requirements for SW

**SM** Atterberg limits below "A" line or P.I. less than 4

**SC** Atterberg limits above "A" line with P.I. greater than 7

Limits plotting in hatched zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols

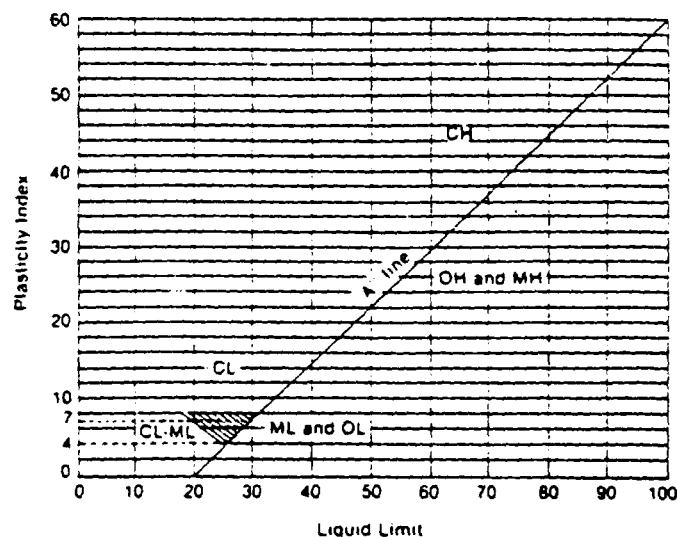
Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 per cent ..... GW, GP, SW, SP

More than 12 per cent ..... GM, GC, SM, SC

5 to 12 per cent ..... Borderline cases requiring dual symbols

## PLASTICITY CHART



For classification of fine-grained soils and fine fraction of coarse-grained soils.

Atterberg Limits plotting in hatched area are borderline classifications requiring use of dual symbols.

Equation of A-line:  $PI = 0.73(LL - 20)$

# LOG OF TEST BORING



## General Notes

### Descriptive Soil Classification

#### GRAIN SIZE TERMINOLOGY

Soil Fraction	Particle Size	U.S. Standard Sieve Size
Boulders	Larger than 12"	Larger than 12"
Cobbles	3" to 12"	3" to 12"
Gravel: Coarse	3/4" to 3"	3/4" to 3"
Fine	4.75 mm to 3/4"	#4 to 3/4"
Sand: Coarse	2.00 mm to 4.75 mm	#10 to #4
Medium	0.42 mm to 2.00 mm	#40 to #10
Fine	0.075 mm to 0.42 mm	#200 to #40
Silt	0.005 mm to 0.075 mm	Smaller than #200
Clay	Smaller than 0.005 mm	Smaller than #200

Plasticity characteristics differentiate between silt and clay.

#### GENERAL TERMINOLOGY

Physical Characteristics
Color, moisture, grain shape, fineness, etc.
Major Constituents
Clay, silt, sand, gravel
Structure
Laminated, varved, fibrous, stratified, cemented, fissured, etc.
Geologic Origin
Glacial, alluvial, eolian, residual, etc.

#### RELATIVE PROPORTIONS OF COHESIONLESS SOILS

Proportional Term	Defining Range By Percentage of Weight
Trace	0%- 5%
Little	5%-12%
Some	12%-35%
And	35%-50%

#### ORGANIC CONTENT BY COMBUSTION METHOD

Soil Description	Loss on Ignition
Non Organic	Less than 4%
Organic Silt/Clay	4-12%
Sedimentary Peat	12-50%
Fibrous and Woody Peat	More than 50%

The penetration resistance, *N*, is the summation of the number of blows required to effect two successive 8" penetrations of the 2" split-barrel sampler. The sampler is driven with a 140 lb. weight falling 30" and is seated to a depth of 8" before commencing the standard penetration test.

#### RELATIVE DENSITY

Term	"N" Value
Very Loose	0-4
Loose	4-10
Medium Dense	10-30
Dense	30-50
Very Dense	Over 50

#### CONSISTENCY

Term	<i>q</i> , tons/sq. ft.
Very Soft	0.0 to 0.25
Soft	0.25 to 0.50
Medium	0.50 to 1.0
Stiff	1.0 to 2.0
Very Stiff	2.0 to 4.0
Hard	Over 4.0

#### PLASTICITY

Term	Plastic Index
None to Slight	0-4
Slight	5-7
Medium	8-22
High to Very High	Over 22

## Symbols

### DRILLING AND SAMPLING

CS—Continuous Sampling
RC—Rock Coring: Size AW, BW, NW, 2" W
RQD—Rock Quality Designator
RB—Rock Bit
FT—Fish Tail
DC—Drive Casing
C—Casing: Size 2 1/2", NW, 4", HW
CW—Clear Water
DM—Drilling Mud
HSA—Hollow Stem Auger
FA—Flight Auger
HA—Hand Auger
COA—Clean-Out Auger
SS—2" Diameter Split-Barrel Sample
2ST—2" Diameter Thin-Walled Tube Sample
3ST—3" Diameter Thin-Walled Tube Sample
PT—3" Diameter Piston Tube Sample
AS—Auger Sample
WS—Wash Sample
PTS—Peat Sample
PS—Pitcher Sample
NR—No Recovery
S—Sounding
PMT—Borehole Pressuremeter Test
VS—Vane Shear Test
WPT—Water Pressure Test

### LABORATORY TESTS

<i>q</i> —Penetrometer Reading, tons/sq. ft.
<i>q<sub>u</sub></i> —Unconfined Strength, tons/sq. ft.
W—Moisture Content, %
LL—Liquid Limit, %
PL—Plastic Limit, %
SL—Shrinkage Limit, %
LI—Loss on Ignition, %
D—Dry Unit Weight, lbs./cu. ft.
pH—Measure of Soil Alkalinity or Acidity
FS—Free Swell, %

### WATER LEVEL MEASUREMENT

▽—Water Level at time shown
NW—No Water Encountered
WD—While Drilling
BCR—Before Casing Removal
ACR—After Casing Removal
CW—Caved and Wet
CM—Caved and Moist

Note: Water level measurements shown on the boring logs represent conditions at the time indicated and may not reflect static levels, especially in cohesive soils.

**WARZYN****ENGINEERING INC****LOG OF TEST BORING**

Project Hydrogeologic Investigation  
Outboard Marine Corporation  
 Location Waukegan, Illinois

Boring No. 1  
 Surface Elevation \_\_\_\_\_  
 Job No. C. 8342  
 Sheet 1 of 1

1409 EMIL STREET • P.O. BOX 9538, MADISON, WIS. 53715 • TEL. (608) 257-4848

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
Recovery		Moisture		N	Depth		q <sub>u</sub>	W	LL	PL	D
No.	Type	↓	↓								
1	SS	X	M	29		Fill Material; Brown Fine to Coarse SAND, Little Gravel, Little Silt & Clay (SP-SM)					
2	SS	X	W	32	5						
3	SS	X	W	22							
						Dark Gray Fine SAND, trace Silt & Fibrous Organic Material (SP)					
						End Boring at 7.5'					
					10						
					15						
					20						
					25						
					30						
					35						
					40						

WATER LEVEL OBSERVATIONS						GENERAL NOTES	
While Drilling	<u>3.5</u>					Start	<u>7/18/78</u> Complete <u>7/18/79</u>
Upon Completion of Drilling						Crew Chief	<u>JWG. Rig CME 55-1</u>
Time After Drilling	<u>1/2 hour</u>					Drilling Method	<u>Washbore</u>
Depth to Water	<u>3.4</u>						
Depth to Cave In							

**WARZYN****ENGINEERING INC****LOG OF TEST BORING**

Project Hydrogeologic Investigation  
Outboard Marine Corporation  
 Location Waukegan, Illinois

Boring No. 2A  
 Surface Elevation                       
 Job No. C.8342  
 Sheet 1 of 1

1409 EMIL STREET • P.O. BOX 9538, MADISON, WIS. 53715 • TEL. (608) 257-4848

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
Recovery		Moisture		N	Depth		q <sub>v</sub>	W	LL	PL	D
No.	Type	↓	↓								
						See Log of Test Boring #2C					
						End Boring at 8.5'					

WATER LEVEL OBSERVATIONS						GENERAL NOTES	
While Drilling						Start	7/19/79 Complete 7/19/79
Upon Completion of Drilling						Crew Chief	JWG Rig CME 55-1
Time After Drilling						Drilling Method	Washbore
Depth to Water							
Depth to Cave In							

**WARZYN****ENGINEERING INC****LOG OF TEST BORING**

Project Hydrogeologic Investigation  
Outboard Marine Corporation  
 Location Waukegan, Illinois

Boring No. 28  
 Surface Elevation \_\_\_\_\_  
 Job No. C 8342  
 Sheet 1 of 1

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SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
Recovery		Moisture		N	Depth		q <sub>v</sub>	W	LL	PL	D
No.	Type	↓	↓								
						See Log of Test Boring #2C					
						End Boring at 20'					

WATER LEVEL OBSERVATIONS						GENERAL NOTES	
While Drilling						Start	7/20/78
Upon Completion of Drilling						Complete	7/20/79
Time After Drilling						Crew Chief	JWG. Rig CME 55-1
Depth to Water						Drilling Method	Washbore
Depth to Cave In							



# LOG OF TEST BORING

Project Hydrogeologic Investigation  
Outboard Marine Corporation  
Location Waukegan, Illinois

Boring No. 2C  
Surface Elevation  
Job No. C 8342  
Sheet 1 of 1

1409 EMIL STREET • P.O. BOX 9538, MADISON, WIS. 53715 • TEL. (608) 257-4848

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
Recovery			Moisture				q <sub>u</sub>	W	LL	PL	D
No.	Type	↓	↓	N	Depth						
1	SS	X	W	18		Fill Material; Brown Fine to Coarse SAND, Trace Silt (SP)					
2	SS	X	W	27	5	Gray-Brown Fine to Coarse SAND, Little Gravel, Trace Silt and Clay (SP)					
3	SS	X	W	25							
4	SS	X	W	21	10						
5	SS	X	W	21	15	Gray-Brown Fine SAND, Little Silt & Clay (SP-SM)					
6	SS	X	W	25	20						
7	SS	X	W	30	25						
8	SS	X	W	30	30						
						Gray SILT, Trace Clay, Trace Sand (ML)					
9	SS	X	W	50	35	End Boring at 35'					
						* Dark Gray Fine SAND, Fibrous Organic Material (SP)					
					40						
WATER LEVEL OBSERVATIONS						GENERAL NOTES					
While Drilling <u>3.2</u>						Start <u>7/19/78</u> Complete <u>7/19/78</u>					
Upon Completion of Drilling _____						Crew Chief <u>JWG</u> Rig <u>CME 55-1</u>					
Time After Drilling <u>1/2 hour</u>						Drilling Method _____					
Depth to Water <u>3.2</u>						Washbore _____					
Depth to Cave In _____						_____					

LIST OF TABLES

Table 1	-	Summary of Baildown Permeability Test Results
Table 2	-	Summary of Groundwater Elevations
Table 3	-	Summary of Soil Characteristics
Table 4	-	Staff Gage Data from OMC Drainage Ditch

Table 1 Summary of Baildown Permeability Test Results

Well No.	Permeability cm/sec	Screened Interval Below Ground	Classification of Soil
1	$7.78 \times 10^{-4}$	3.4-8.4	FILL; SAND, Little Gravel, Trace-Little Silt & Clay (SP, SP-SM)
2A	a	3.3-8.3	SAND, Little Gravel, Trace Silt & Clay, Organic (SP)
2B	$8.51 \times 10^{-3}$	17.5-19.5	SAND, Little Silt & Clay (SP-SM)
2C	$2.14 \times 10^{-4}$	29.5-31.5	SILT, Some Clay, Trace Sand (ML)
3	$2.14 \times 10^{-4}$	6.6-11.6	SAND, Trace to Little Silt & Clay (SP-SM)
4A	$1.20 \times 10^{-3}$	<u>3.0</u> -8.3	SAND, Some Gravel, Trace Silt & Clay (SP-SM)
4B	$1.96 \times 10^{-3}$ to $7.13 \times 10^{-4}$	17.3-19.3	SAND, Trace to Little Silt & Clay, Trace Gravel (SP-SM)
4C	$1.52 \times 10^{-3}$ to $3.83 \times 10^{-3}$	24.3-26.3	SAND, Trace to Little Silt & Clay, Trace Gravel (SP-SM)
5	$1.73 \times 10^{-3}$	<u>3.7</u> -8.7	FILL; SAND, Trace Gravel, Trace Silt & Clay (SP)
6	$1.17 \times 10^{-3}$	4.3-9.3	SAND, Trace Silt & Clay (SP)
7A	a	3.3-8.3	SAND, Trace Silt & Clay, Trace to Little Gravel (SP, SP-SM, SM)
7B	$1.76 \times 10^{-3}$	13.6-15.6	SAND, Trace Silt & Clay, Trace to Little Gravel (SP, SP-SM, SM)
7C	$7.65 \times 10^{-3}$	20.3-22.3	SAND, Trace Silt & Clay, Trace to Little Gravel (SP, SP-SM, SM)
8	$3.99 \times 10^{-4}$	<u>3.4</u> -8.4	FILL; Foundry Sand, Organic Material, Trace Silt & Clay (SW-SM, ML, SP)
9	$1.96 \times 10^{-4}$	3.3-8.3	FILL; SAND, Some Silt & Clay, Little Gravel (SM)

a. Recovery of water too fast to measure; Permeability probably on the order of  $5 \times 10^{-3}$  CM/SEC.

TABLE 2 Summary of Groundwater Elevations

Well No.	Elevation of Ground Surface	Elevation of Top of Well	Elevation of Protective Casing	Well Depth	JULY 25, 1979	
					Depth to Water <sup>a</sup>	Water Elevation
1	584.6	586.37	587.66	8.7	5.83	581.83
2A	583.1	584.98	585.31	8.6	3.61	581.70
2B	583.2	585.83	586.00	19.9	4.25	581.75
2C	583.1	586.28	586.49	31.8	4.74	581.75
3	589.8	593.25	593.38	11.9	11.67	581.71
4A	584.0	585.93	586.22	8.6	4.42	579.78
4B	583.9	586.80	586.74	19.6	4.95	581.85
4C	583.9	587.23	587.43	26.6	5.72	581.71
5	585.5	586.98	588.88	9.0	6.68	582.20
6	585.6	589.01	588.92	9.6	7.25	581.76
7A	585.0	586.92	587.45	8.6	--	---
7B	584.8	587.36	587.75	15.9	--	---
7C	584.9	587.34	588.01	22.6	--	---
8	588.9	590.68	591.25	8.7	7.14	584.11
9	586.3	588.21	588.84	8.6	6.21	582.63

<sup>a</sup> Measured from Highest Point on Protective Casing or Stainless Steel Well Pipe, Whichever is Higher.

NOTE: All Elevations Relative to Mean Sea Level.

TABLE 2 Summary of Groundwater Elevations (Cont.)

Well No.	Elevation of Ground Surface	Elevation of Top of Well	Elevation of Protective Casing	Well Depth	JULY 26, 1979	
					Depth to Water <sup>a</sup>	Water Elevation
1	584.6	586.37	587.66	8.7	5.87	581.79
2A	583.1	584.98	585.31	8.6	3.34	581.97
2B	583.2	585.83	586.00	19.9	4.01	581.99
2C	583.1	586.28	586.49	31.8	4.51	581.98
3	589.8	593.25	593.38	11.9	11.44	581.94
4A	584.0	585.93	586.22	8.6	4.13	579.82
4B	583.9	586.80	586.74	19.6	4.79	582.01
4C	583.9	587.23	587.43	26.6	5.48	581.95
5	585.5	586.98	588.38	9.0	6.65	582.23
6	585.6	589.01	588.92	9.6	7.22	581.79
7A	585.0	586.92	587.45	8.6	5.35	582.10
7B	584.8	587.36	587.75	15.9	5.63	582.12
7C	584.9	587.34	588.01	22.6	--	---
8	588.9	590.68	591.25	8.7	7.18	584.07
9	586.3	588.21	588.84	8.6	6.30	584.95

<sup>a</sup> Measured from Highest Point on Protective Casing or Stainless Steel Well Pipe, Whichever is Higher.

NOTE: All Elevations Relative to Mean Sea Level.

TABLE 2 Summary of Groundwater Elevations (Cont.)

Well No.	Elevation of Ground Surface	Elevation of Top of Well	Elevation of Protective Casing	Well Depth	JULY 27, 1979	
					Depth to Water <sup>a</sup>	Water Elevation
1	584.6	586.37	587.66	8.7	5.84	581.82
2A	583.1	584.98	585.31	8.6	3.84	581.47
2B	583.2	585.83	586.00	19.9	4.48	581.52
2C	583.1	586.28	586.49	31.8	4.96	581.53
3	589.8	593.25	593.38	11.9	11.80	581.58
4A	584.0	585.93	586.22	8.6	4.64	579.36
4B	583.9	586.80	586.74	19.6	5.25	581.55
4C	583.9	587.23	587.43	26.6	5.93	581.50
5	585.5	586.98	588.38	9.0	6.65	582.23
6	585.6	589.01	588.92	9.6	7.23	581.78
7A	585.0	586.92	587.45	8.6	5.78	581.67
7B	584.8	587.36	587.75	15.9	6.04	581.71
7C	584.9	587.34	588.01	22.6	6.39	581.62
8	588.9	590.68	591.25	8.7	7.18	584.07
9	586.3	588.21	588.84	8.6	6.27	584.98

<sup>a</sup> Measured from Highest Point on Protective Casing or Stainless Steel Well Pipe, Whichever is Higher.

NOTE: All Elevations Relative to Mean Sea Level.





# LOG OF TEST BORING

Project Hydrogeologic Investigation  
Outboard Marine Corporation  
Location Waukegan, Illinois

Boring No. 3  
Surface Elevation  
Job No. C 8342  
Sheet 1 of 1

1409 EMIL STREET • P.O. BOX 9538, MADISON, WIS. 53715 • TEL. (608) 257-4848

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
Recovery			Moisture				q <sub>u</sub>	W	LL	PL	D
No.	Type	↓	↓	N	Depth						
1	SS	X	M	14	5	Fill Material; Gray Fine SAND, Trace to Little Silt and Clay (SP-SM)  Ash Fill, 4-5'					
2	SS	X	M	20							
3	SS	X	M	35							
4	SS	X	W	14							
					10	Gray-Brown Fine SAND, Trace Silt & Clay (SP)					
						End Boring at 10'					
					15						
					20						
					25						
					30						
					35						
					40						
WATER LEVEL OBSERVATIONS						GENERAL NOTES					
While Drilling <u>7' 6"</u>						Start <u>7/23/79</u> Complete <u>7/23/79</u>					
Upon Completion of Drilling _____						Crew Chief <u>JWG RIG CME 55-1</u>					
Time After Drilling <u>¼ hour</u>						Drilling Method _____					
Depth to Water <u>8.0</u>						Washbore _____					
Depth to Cave In _____						_____					



Boring No. 4A  
Surface Elevation  
Job No. C 8342  
Sheet 1 of 1

WATER LEVEL OBSERVATIONS						GENERAL NOTES	
While Drilling						Start	7/23/79
Upon Completion of Drilling						Complete	7/23/79
Time After Drilling	<u>1/2 hour</u>					Crew Chief	JWG Rig CME 55-1
Depth to Water						Drilling Method	
Depth to Cave In						Washbore	

**WARZYN****ENGINEERING INC****LOG OF TEST BORING**

Project Hydrogeologic Investigation  
 Outboard Marine Corporation  
 Location Waukegan, Illinois

Boring No. 48  
 Surface Elevation  
 Job No. C 8342  
 Sheet 1 of 1

1409 EMIL STREET • P.O. BOX 9538, MADISON, WIS. 53715 • TEL. (608) 257-4848

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
Recovery		Moisture		Depth	q <sub>v</sub>		W	LL	PL	D	
No.	Type	✓	✓		N						
						See Log of Test Boring #4C					
					5	End Boring at 20'					
					10	End Boring at 20'					
					15	End Boring at 20'					
					20	End Boring at 20'					
					25	End Boring at 20'					
					30	End Boring at 20'					
					35	End Boring at 20'					
					40	End Boring at 20'					

**WATER LEVEL OBSERVATIONS****GENERAL NOTES**

While Drilling \_\_\_\_\_  
 Upon Completion of Drilling \_\_\_\_\_  
 Time After Drilling  $\frac{1}{2}$  hour \_\_\_\_\_  
 Depth to Water \_\_\_\_\_  
 Depth to Cave In \_\_\_\_\_

Start 7/24/78 Complete 7/24/78  
 Crew Chief JWG. Rig CME. 55-1  
 Drilling Method \_\_\_\_\_  
 Washbore \_\_\_\_\_



**ENGINEERING INC**

# LOG OF TEST BORING

Project Hydrogeologic Investigation  
Outboard Marine Corporation  
Location Waukegan, Illinois

Boring No. .... 4C .....  
Surface Elevation .....  
Job No. .... C 8342 .....  
Sheet ....]..... of ....]

1409 EMIL STREET • P.O. BOX 9538, MADISON, WIS. 53715 • TEL. (608) 257-4848

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES					
Recovery			Moisture				q <sub>v</sub>	W	LL	PL	D	
No.	Type	↓	↓	N	Depth							
1	SS	X	M	12		Fill Material; Brown Fine to Medium SAND, Trace Silt, Trace Gravel (SP)						
2	SS	X	W	39	5		Gray-Brown Fine to Coarse SAND, Some Gravel, Trace Silt & Clay (SP-SM)					
3	SS	X	W	20								
	SS	X	W	43	10	Gray Fine SAND, Trace to Little Silt & Clay, Trace Gravel (SP-SM)						
5	SS	X	W	24	15							
6	SS	X	W	43	20							
7	SS	X	W	46	25	Gray SILT, Some Clay (ML)						
8	SS	X	W	84	30		End Boring at 30'	4.5+				
					35							
					40							
WATER LEVEL OBSERVATIONS						GENERAL NOTES						
While Drilling <u>2' 6"</u>						Start <u>7/24/79</u> Complete <u>7/24/79</u>						
Upon Completion of Drilling _____						Crew Chief <u>JWG Rig CME 55-1</u>						
Time After Drilling <u>½ hour</u> _____						Drilling Method _____						
Depth to Water _____						Washbore _____						
Depth to Cave In _____						_____						



**ENGINEERING INC**

# LOG OF TEST BORING

Project Hydrogeologic Investigation  
Outboard Marine Corporation  
Location Waukegan, Illinois

Boring No. 5  
Surface Elevation  
Job No. C 8342  
Sheet 1 of 1

1409 EMIL STREET • P.O. BOX 9538, MADISON, WIS. 53715 • TEL. (608) 257-4848

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES					
Recovery			Moisture				q <sub>u</sub>	W	LL	PL	D	
No.	Type	↓	↓	N	Depth							
1	SS	X	M	14	5	Clay Layer 2-2.5' Fill Material; Gray Fine SAND, Trace Gravel, Trace Silt & Clay (SP) Organic Layer 5-5.5'						
2	SS	X	W	2								
3	SS	X	W	3								
4	SS	X	W	2								
					10	End Boring at 9'						
WATER LEVEL OBSERVATIONS						GENERAL NOTES						
While Drilling <u>3.0</u>						Start <u>7/25/78</u> Complete <u>7/25/78</u>						
Upon Completion of Drilling _____						Crew Chief <u>JWGRig CME 55-1</u>						
Time After Drilling <u>1/2 hour</u>						Drilling Method _____						
Depth to Water _____						Washbore _____						
Depth to Cave In _____						_____						

**WARZYN****ENGINEERING INC****LOG OF TEST BORING**

Project Hydrogeologic Investigation  
Outboard Marine Corporation  
 Location Waukegan, Illinois

Boring No. 6  
 Surface Elevation             
 Job No. C 8342  
 Sheet 1 of 1

1409 EMIL STREET • P.O. BOX 9538, MADISON, WIS. 53715 • TEL. (608) 257-4848

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES					
Recovery		Moisture		N	Depth		Qu	W	LL	PL	D	
No.	Type	↓	↓									
1	SS	X	M	19	5	Fill Material; Fine to Coarse SAND, Trace Silt & Clay, Trace Gravel, Occasional Brick Chip (SP)						
2	SS	X	W	24								
3	SS	X	W	37	10	Gray Fine SAND, Trace Silt & Clay (SP)						
4	SS	X	W	33								
						End Boring at 10'						
WATER LEVEL OBSERVATIONS						GENERAL NOTES						
While Drilling <u>3.7</u>						Start <u>7/25/79</u> Complete <u>7/25/79</u>						
Upon Completion of Drilling <u>          </u>						Crew Chief <u>JWG Rig CME 55-1</u>						
Time After Drilling <u>1/2 hour</u>						Drilling Method <u>          </u>						
Depth to Water <u>          </u>						Washbore <u>          </u>						
Depth to Cave In <u>          </u>												

**WARZYN****ENGINEERING INC****LOG OF TEST BORING**

Project Hydrogeologic Investigation  
Outboard Marine Corporation  
 Location Waukegan, Illinois

Boring No. 7A  
 Surface Elevation \_\_\_\_\_  
 Job No. C 8342  
 Sheet 1 of 1

1409 EMIL STREET • P.O. BOX 9538, MADISON, WIS. 53715 • TEL. (608) 257-4848

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
Recovery		Moisture		N	Depth		q <sub>v</sub>	W	LL	PL	D
No.	Type	↓	↓								
						See Log of Test Boring #7C					
					5	End Boring at 10'					
					10	End Boring at 10'					
					15	End Boring at 10'					
					20	End Boring at 10'					
					25	End Boring at 10'					
					30	End Boring at 10'					
					35	End Boring at 10'					
					40	End Boring at 10'					

WATER LEVEL OBSERVATIONS						GENERAL NOTES	
While Drilling						Start	7/26/79 Complete 7/26/79
Upon Completion of Drilling						Crew Chief	JWG Rig CME .55-1
Time After Drilling						Drilling Method	Washbore
Depth to Water							
Depth to Cave In							



**ENGINEERING INC**

# LOG OF TEST BORING

Project Hydrogeologic Investigation  
Outboard Marine Corporation  
Location Waukegan, Illinois

Boring No. 7B  
Surface Elevation  
Job No. C 8342  
Sheet 1 of 1

1409 EMIL STREET • P.O. BOX 9538, MADISON, WIS. 53715 • TEL. (608) 257-4848

SAMPLE					VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES					
Recovery		Moisture				q <sub>u</sub>	W	LL	PL	D	
No.	Type	↓	↓	N	Depth						
					See Log of Test Boring #7C						
					End Boring at 15'						

WATER LEVEL OBSERVATIONS						GENERAL NOTES	
While Drilling _____						Start <u>7/26/79</u> Complete <u>7/26/79</u>	
Upon Completion of Drilling _____						Crew Chief <u>JWG Rig CME 55-1</u>	
Time After Drilling _____						Drilling Method _____	
Depth to Water _____						Washbore _____	
Depth to Cave In _____						_____	



**ENGINEERING INC**

# LOG OF TEST BORING

Project Hydrogeologic Investigation  
Outboard Marine Corporation  
Location Waukegan, Illinois

Boring No. 7C  
Surface Elevation  
Job No. C 8342  
Sheet 1 of 1

1409 EMIL STREET • P.O. BOX 9538, MADISON, WIS. 53715 • TEL. (608) 257-4848

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
Recovery			Moisture				q <sub>v</sub>	W	LL	PL	D
No.	Type	↓	↓	N	Depth						
1	SS	X	M	7	5-10	Brown Fine to Medium SAND, Trace Silt (SP)					
2	SS	X	W	19		Gray Fine SAND, Trace Silt & Clay, Trace to Little Gravel (SP,SM-SP,SM)					
3	SS	X	W	26							
4	SS	X	W	21							
5	SS	X	W	24							
6	SS	X	W	50 / 10							
7	SS	X	M	74	25	SILT, Some Clay, Sand, Trace Gravel (ML)	4.5+		16.3	12.6	
						End Boring at 25'					
					30						
					35						
					40						

### WATER LEVEL OBSERVATIONS

While Drilling 2.5

Upon Completion of Drilling \_\_\_\_\_

Time After Drilling ¼ hour \_\_\_\_\_

Depth to Water \_\_\_\_\_

Depth to Cave In \_\_\_\_\_

### GENERAL NOTES

Start 7/26/78 Complete 7/26/78

Crew Chief JWG Rig CME 55-1

Drilling Method Washbore

**WARZYN****ENGINEERING INC****LOG OF TEST BORING**

Project Hydrogeologic Investigation  
Outboard Marine Corporation  
 Location Waukegan, Illinois

Boring No. 8  
 Surface Elevation             
 Job No. C 8342  
 Sheet 1 of 1

1409 EMIL STREET • P.O. BOX 9538, MADISON, WIS. 53715 • TEL. (608) 257-4848

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
Recovery			Moisture				q <sub>u</sub>	W	LL	PL	D
No.	Type	↓	↓	N	Depth						
						Fill Material; Foundry SAND, Concrete Sand and Gravel, Trace Silt & Clay (SW-SM)					
1	SS	X	W	108	5						
2	SS	X	W	3		* Brownish-Black Fine SAND, Trace Silt (SP)					
						End Boring at 7.5'					
					10	* Brownish-Black Organic SILT, Fibrous Material (ML)					
					15						
					20						
					25						
					30						
					35						
					40						
WATER LEVEL OBSERVATIONS						GENERAL NOTES					
While Drilling <u>4' 5"</u>						Start <u>7/17/79</u> Complete <u>7/17/79</u>					
Upon Completion of Drilling <u>          </u>						Crew Chief <u>JWG. Rig CME. 55-1</u>					
Time After Drilling <u>½ hour</u>						Drilling Method <u>          </u>					
Depth to Water <u>4' 6"</u>						Auger <u>          </u>					
Depth to Cave In <u>          </u>											

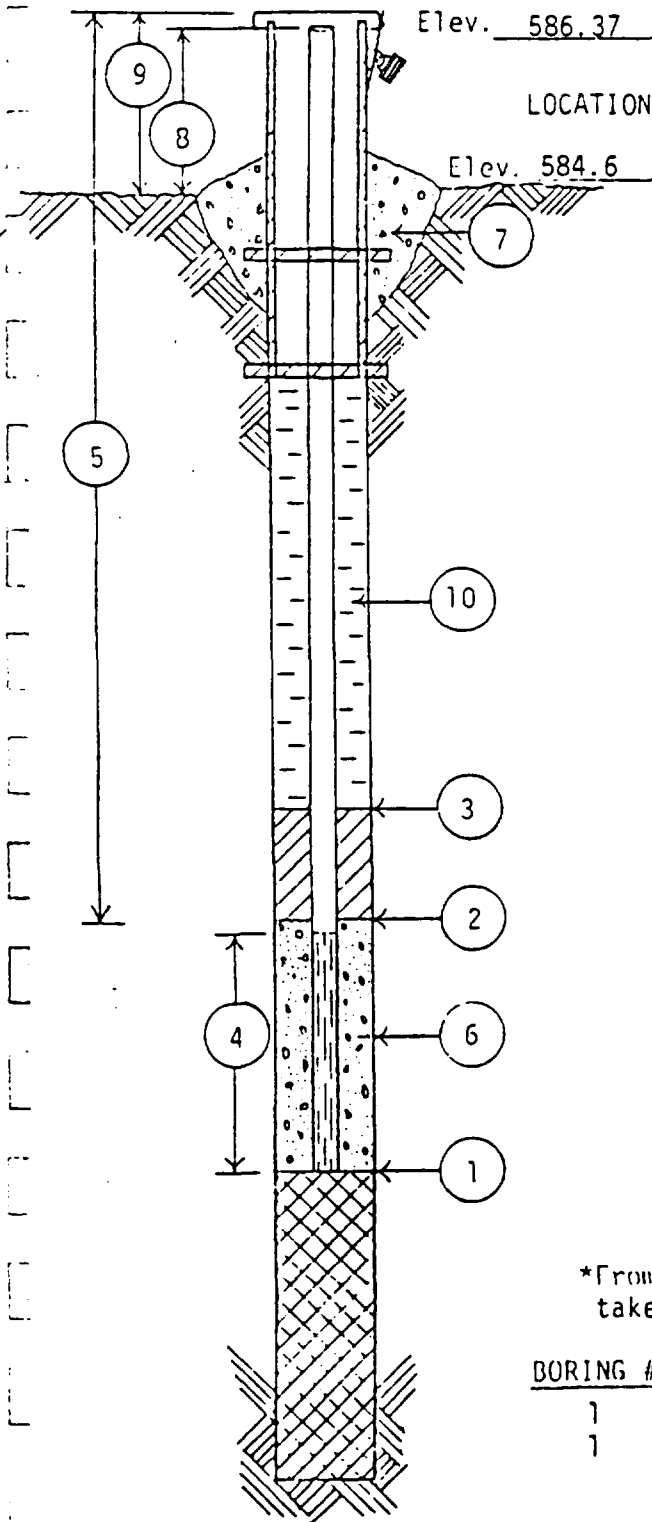


Boring No. 9  
Surface Elevation  
Job No. C 8342  
Sheet 1 of 1

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES					
Recovery			Moisture				q <sub>u</sub>	W	LL	PL	D	
No.	Type	↓	↓	N	Depth							
1	SS	X	M	17	5	Fill Material; Gray-Brown Fine to Coarse SAND, Some Silt & Clay, Little Gravel, Occasional Cinders and Glass (SM)						
2	SS	X	W	4								
3	SS	X	W	9								
4	SS	X	W	15	10	Gray Fine to Coarse SAND, Trace Silt & Clay (SP)						
5	SS	X	W	14								
6	SS	X	W	42								
7	SS	X	M	41	25	Gray SILT, Some Clay, Trace Sand (ML-CL)	4.5					
							4.5+		21.2	16.2		
8	SS	X	M	78	30	End Boring at 27.5'						
					35							
					40							
WATER LEVEL OBSERVATIONS						GENERAL NOTES						
White Drilling 3' 7"						Start 7/17/79 Complete 7/17/79						
Upon Completion of Drilling						Crew Chief JWG Rig CME 55-1						
Time After Drilling ¼ hour						Drilling Method						
Depth to Water						Washbore						
Depth to Cave In												

JOB NO. 8342BORING NO. 1DATE 7/18/79CHIEF Jim GriegerLOCATION OMC-Waukegan, Illinois

All depth measurements of well detail assumed to be from ground surface unless otherwise indicated.



- 1 DEPTH TO BOTTOM OF WELL POINT OR SLOTTED PIPE 8.7 FEET.
- 2 DEPTH OF BOTTOM OF SEAL (if installed) - FEET.
- 3 DEPTH TO TOP OF SEAL (if installed) - FEET.
- 4 LENGTH OF WELL POINT, PVC WELL SCREEN, OR SLOTTED PIPE 5.5 FEET. (Circle One)
- 5 TOTAL LENGTH OF PIPE 5 FEET @ 1 1/2 IN. DIAMETER.
- 6 TYPE OF FILTER MATERIAL AROUND WELL POINT OR SLOTTED PIPE Flint Sand.
- 7 CONCRETE CAP, YES NO (Circle One)
- 8 HEIGHT OF WELL CASING ABOVE GROUND 1.8 FEET.
- 9 PROTECTIVE CASING? YES NO (Circle One)  
HEIGHT ABOVE GROUND 3.1 Ft.
- 10 LOCKING CAP? YES NO (Circle One)  
TYPE OF BACKFILL: Flint Sand

## WATER LEVEL CHECKS

\*From top of casing, if protective casing higher, take measurement from top of protective casing.

BORING #	DATE	TIME	DEPTH TO WATER	REMARKS
1	7/19/79		5.66	
1	7/20/79		5.75	

JOB NO. 8342

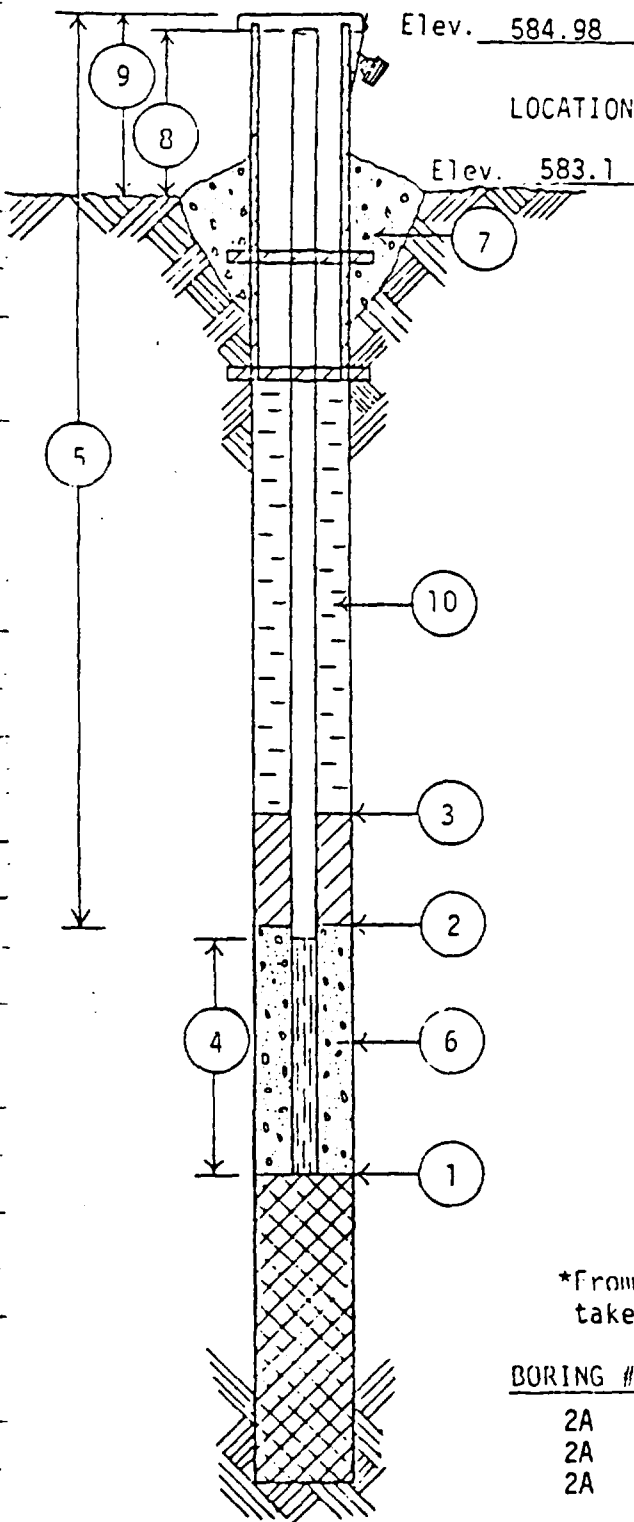
BORING NO. 2A

DATE 7/19/79

CHIEF Jim Grieger

LOCATION OMC-Waukegan, Illinois

All depth measurements of well detail assumed to be from ground surface unless otherwise indicated.



- 1 DEPTH TO BOTTOM OF WELL POINT OR SLOTTED PIPE 8.6 FEET.
- 2 DEPTH OF BOTTOM OF SEAL (if installed) - FEET.
- 3 DEPTH TO TOP OF SEAL (if installed) - FEET.
- 4 LENGTH OF WELL POINT, PVC WELL SCREEN, OR SLOTTED PIPE 5.5 FEET. (Circle One)
- 5 TOTAL LENGTH OF PIPE 5 FEET @ 1 1/2 IN. DIAMETER.
- 6 TYPE OF FILTER MATERIAL AROUND WELL POINT OR SLOTTED PIPE Flint Sand.
- 7 CONCRETE CAP, YES NO (Circle One)
- 8 HEIGHT OF WELL CASING ABOVE GROUND 1.9 FEET.
- 9 PROTECTIVE CASING? YES NO (Circle One) HEIGHT ABOVE GROUND 2.2.
- 10 LOCKING CAP? YES NO (Circle One) TYPE OF BACKFILL: Flint Sand

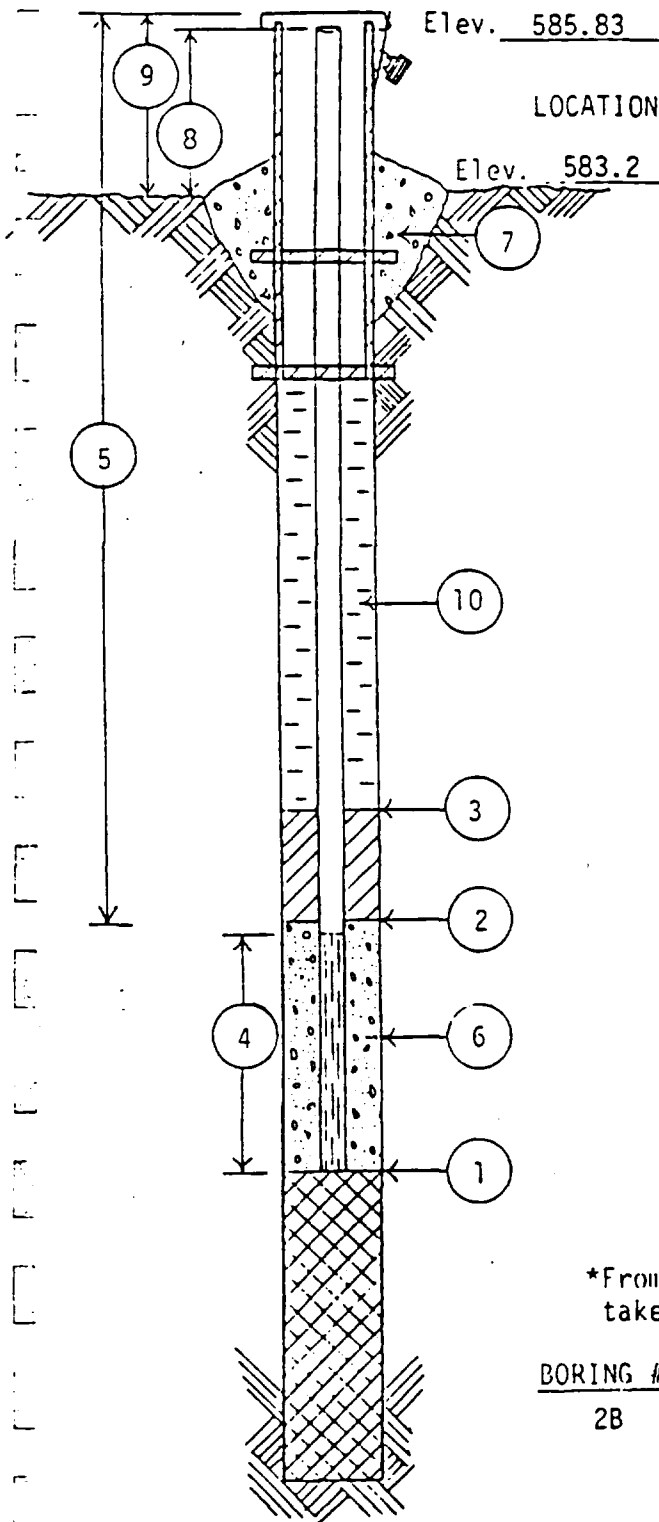
#### WATER LEVEL CHECKS

\*From top of casing, if protective casing higher, take measurement from top of protective casing.

BORING #	DATE	TIME	DEPTH TO WATER	REMARKS
2A	7/19/79		3.83	
2A	7/20/79		3.82	
2A	7/24/79		3.80	

JOB NO. 8342BORING NO. 2BDATE 7/20/79CHIEF Jim GriegerLOCATION OMC-Waukegan, Illinois

All depth measurements of well detail assumed to be from ground surface unless otherwise indicated.



- ① DEPTH TO BOTTOM OF WELL POINT OR SLOTTED PIPE 19.9 FEET.
- ② DEPTH OF BOTTOM OF SEAL (if installed) 17 FEET.
- ③ DEPTH TO TOP OF SEAL (if installed) 14 FEET.
- ④ LENGTH OF WELL POINT, PVC WELL SCREEN, OR SLOTTED PIPE 2.5 FEET. (Circle One)
- ⑤ TOTAL LENGTH OF PIPE 20 FEET @ 1 1/2 IN. DIAMETER.
- ⑥ TYPE OF FILTER MATERIAL AROUND WELL POINT OR SLOTTED PIPE Flint Sand.
- ⑦ CONCRETE CAP, YES NO (Circle One)
- ⑧ HEIGHT OF WELL CASING ABOVE GROUND 2.6 FEET.
- ⑨ PROTECTIVE CASING? YES NO (Circle One) HEIGHT ABOVE GROUND 2.8.
- ⑩ LOCKING CAP? YES NO (Circle One) TYPE OF BACKFILL: Flint Sand & Cave-in

## WATER LEVEL CHECKS

\*From top of casing, if protective casing higher, take measurement from top of protective casing.

BORING #	DATE	TIME	DEPTH TO WATER	REMARKS
2B	7/24/79		4.45	

JOB NO. 8342

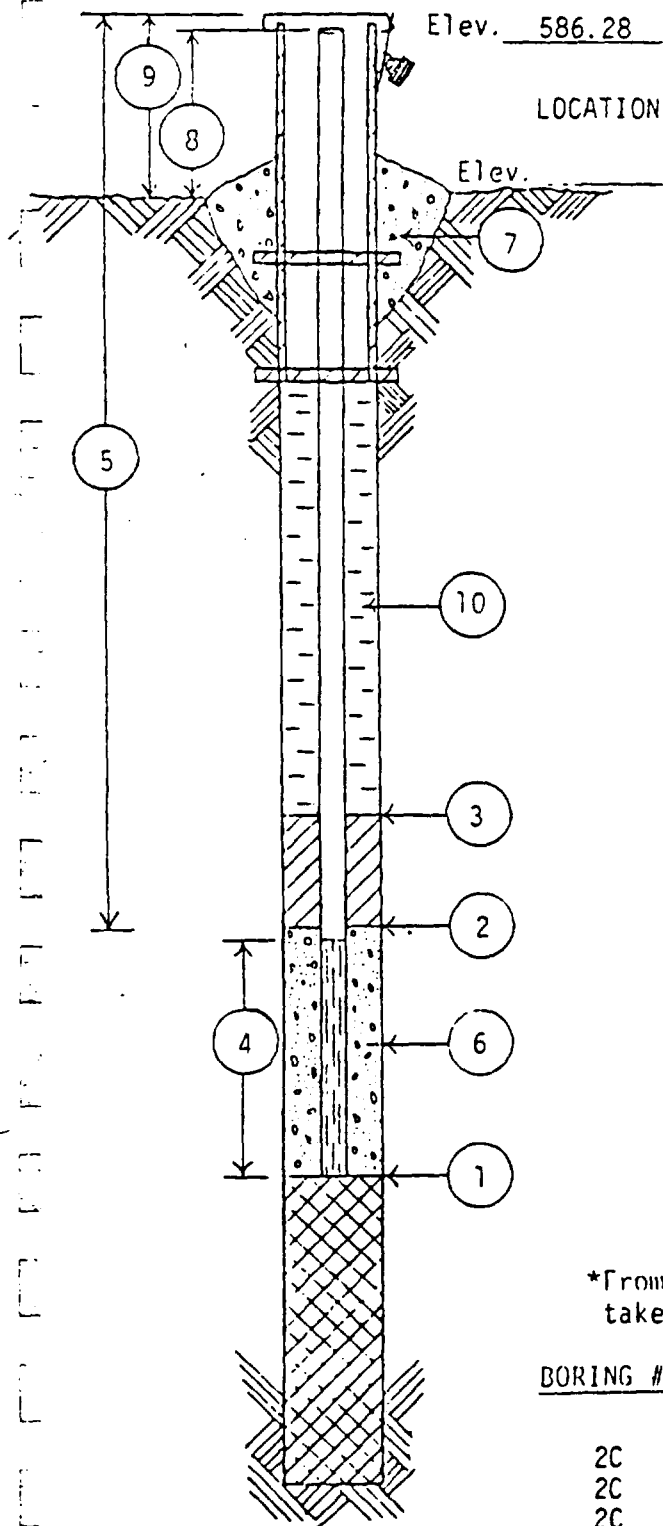
BORING NO. 2C

DATE 7/19/79

CHIEF Jim Grieger

LOCATION OME-Waukegan, Illinois

All depth measurements of well detail assumed to be from ground surface unless otherwise indicated.



- 1 DEPTH TO BOTTOM OF WELL POINT OR SLOTTED PIPE 31.8 FEET.
- 2 DEPTH OF BOTTOM OF SEAL (if installed) 27 FEET.
- 3 DEPTH TO TOP OF SEAL (if installed) 24 FEET.
- 4 LENGTH OF WELL POINT, PVC WELL SCREEN, OR SLOTTED PIPE 2.5 FEET. (Circle One)
- 5 TOTAL LENGTH OF PIPE 32.5 FEET @ 1 1/4 IN. DIAMETER.
- 6 TYPE OF FILTER MATERIAL AROUND WELL POINT OR SLOTTED PIPE Flint Sand.
- 7 CONCRETE CAP, YES NO (Circle One)
- 8 HEIGHT OF WELL CASING ABOVE GROUND 3.2 FEET.
- 9 PROTECTIVE CASING? YES NO (Circle One)  
HEIGHT ABOVE GROUND 3.4.
- 10 LOCKING CAP? YES NO (Circle One)  
TYPE OF BACKFILL: Flint Sand & Cave-in

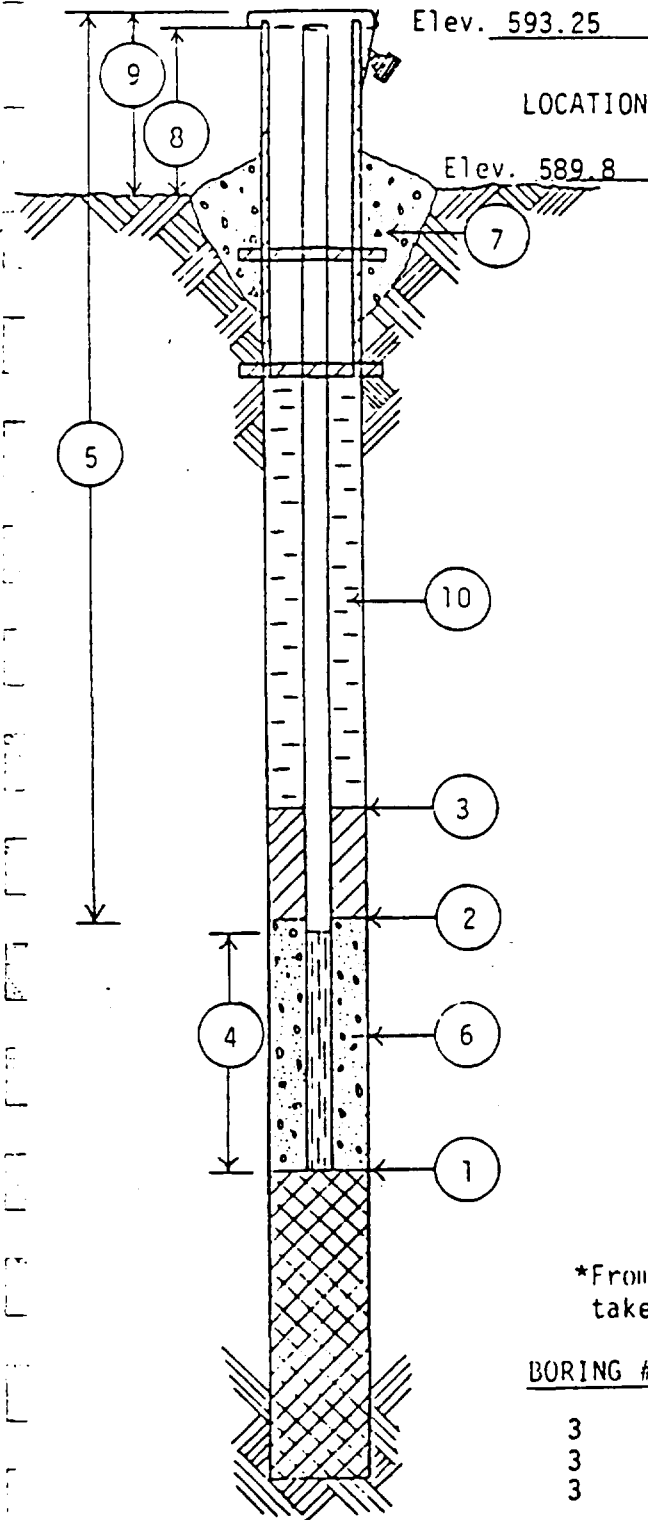
#### WATER LEVEL CHECKS

\*From top of casing, if protective casing higher, take measurement from top of protective casing.

BORING #	DATE	TIME	DEPTH TO WATER	REMARKS
2C	7/19/79		6.20	
2C	7/20/79		5.82	
2C	7/24/79		4.92	

JOB NO. 8342BORING NO. 3DATE 7/23/79CHIEF Jim GriegerLOCATION OMC-Waukegan, Illinois

All depth measurements of well detail assumed to be from ground surface unless otherwise indicated.



- (1) DEPTH TO BOTTOM OF WELL POINT OR SLOTTED PIPE 11.9 FEET.
- (2) DEPTH OF BOTTOM OF SEAL (if installed) - FEET.
- (3) DEPTH TO TOP OF SEAL (if installed) - FEET.
- (4) LENGTH OF WELL POINT, PVC WELL SCREEN, OR SLOTTED PIPE 5.5 FEET. (Circle One)
- (5) TOTAL LENGTH OF PIPE 10 FEET @ 1 1/2 IN. DIAMETER.
- (6) TYPE OF FILTER MATERIAL AROUND WELL POINT OR SLOTTED PIPE Flint Sand.
- (7) CONCRETE CAP, YES NO (Circle One)
- (8) HEIGHT OF WELL CASING ABOVE GROUND 3.6 FEET.
- (9) PROTECTIVE CASING? YES NO (Circle One)  
HEIGHT ABOVE GROUND 3.5.
- (10) LOCKING CAP? YES NO (Circle One)  
TYPE OF BACKFILL: Flint Sand

## WATER LEVEL CHECKS

\*From top of casing, if protective casing higher, take measurement from top of protective casing.

BORING #	DATE	TIME	DEPTH TO WATER	REMARKS
3	7/25/79		11.67	
3	7/26/79		11.44	
3	7/27/79		11.80	

JOB NO. 8342

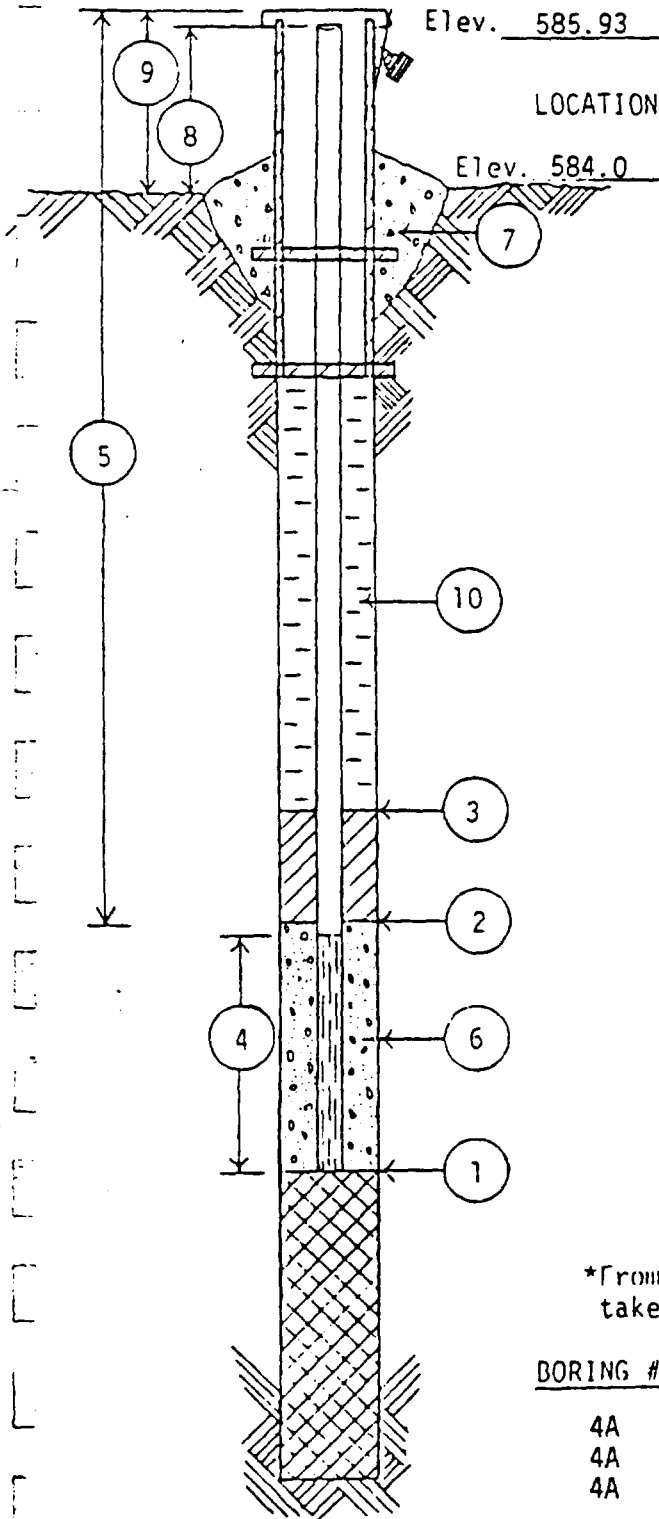
BORING NO. 4A

DATE 7/23/79

CHIEF Jim Grieger

LOCATION OMC-Waukegan, Illinois

All depth measurements of well detail assumed to be from ground surface unless otherwise indicated.



- 1 DEPTH TO BOTTOM OF WELL POINT OR SLOTTED PIPE 8.6 FEET.
- 2 DEPTH OF BOTTOM OF SEAL (if installed) FEET.
- 3 DEPTH TO TOP OF SEAL (if installed) FEET.
- 4 LENGTH OF WELL POINT, PVC WELL SCREEN, OR SLOTTED PIPE 5.5 FEET. (Circle One)
- 5 TOTAL LENGTH OF PIPE 5 FEET @ 1 1/4 IN. DIAMETER.
- 6 TYPE OF FILTER MATERIAL AROUND WELL POINT OR SLOTTED PIPE Flint Sand.
- 7 CONCRETE CAP, YES NO (Circle One)
- 8 HEIGHT OF WELL CASING ABOVE GROUND 1.9 FEET.
- 9 PROTECTIVE CASING? YES NO (Circle One) HEIGHT ABOVE GROUND 2.2.
- 10 LOCKING CAP? YES NO (Circle One) TYPE OF BACKFILL: Flint Sand

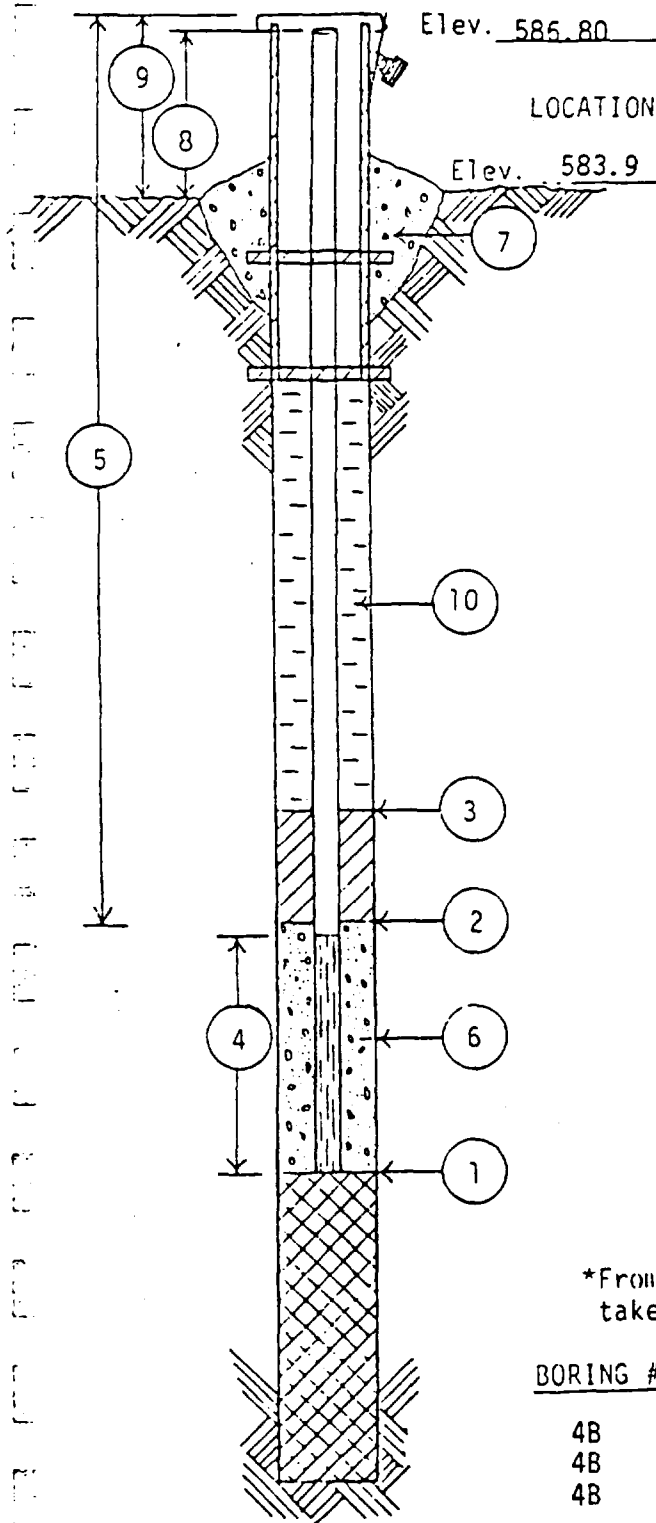
#### WATER LEVEL CHECKS

\*From top of casing, if protective casing higher, take measurement from top of protective casing.

BORING #	DATE	TIME	DEPTH TO WATER	REMARKS
4A	7/25/79		4.42	
4A	7/26/79		4.18	
4A	7/27/79		4.64	

JOB NO. 8342BORING NO. 4BDATE 7/24/79CHIEF Jim GriegerLOCATION OMC-Waukegan, Illinois

All depth measurements of well detail assumed to be from ground surface unless otherwise indicated.



- 1 DEPTH TO BOTTOM OF WELL POINT OR SLOTTED PIPE 19.6 FEET.
- 2 DEPTH OF BOTTOM OF SEAL (if installed) 16 FEET.
- 3 DEPTH TO TOP OF SEAL (if installed) 13 FEET.
- 4 LENGTH OF WELL POINT PVC WELL SCREEN, OR SLOTTED PIPE 2.5 FEET. (Circle One)
- 5 TOTAL LENGTH OF PIPE 20 FEET @ 1 1/2 IN. DIAMETER.
- 6 TYPE OF FILTER MATERIAL AROUND WELL POINT OR SLOTTED PIPE Flint Sand.
- 7 CONCRETE CAP, YES NO (Circle One)
- 8 HEIGHT OF WELL CASING ABOVE GROUND 2.9 FEET.
- 9 PROTECTIVE CASING? YES NO (Circle One)  
HEIGHT ABOVE GROUND 2.8.
- 10 LOCKING CAP? YES NO (Circle One)  
TYPE OF BACKFILL: Flint Sand & Cave-in

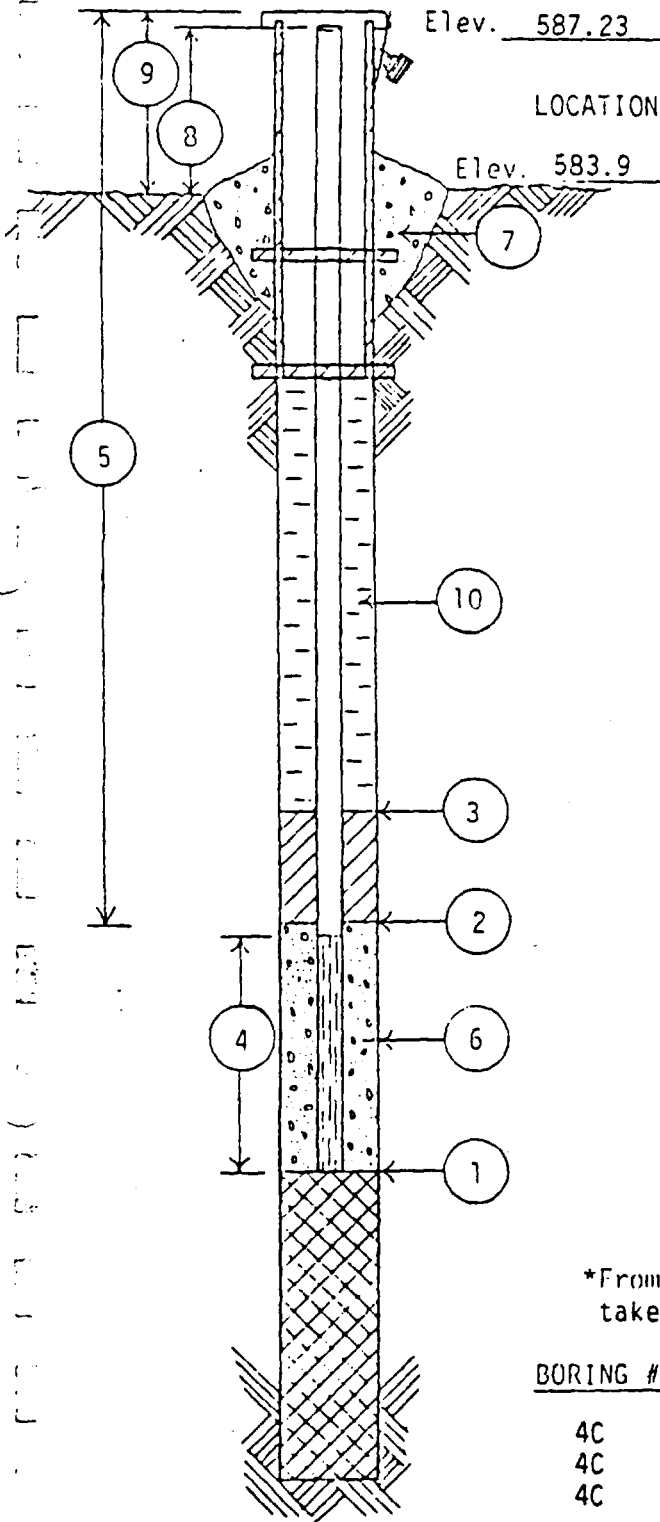
## WATER LEVEL CHECKS

\*From top of casing, if protective casing higher, take measurement from top of protective casing.

BORING #	DATE	TIME	DEPTH TO WATER	REMARKS
4B	7/25/79		4.95	
4B	7/26/79		4.79	
4B	7/27/79		5.25	

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**WARZYN**  
ENGINEERING INC.

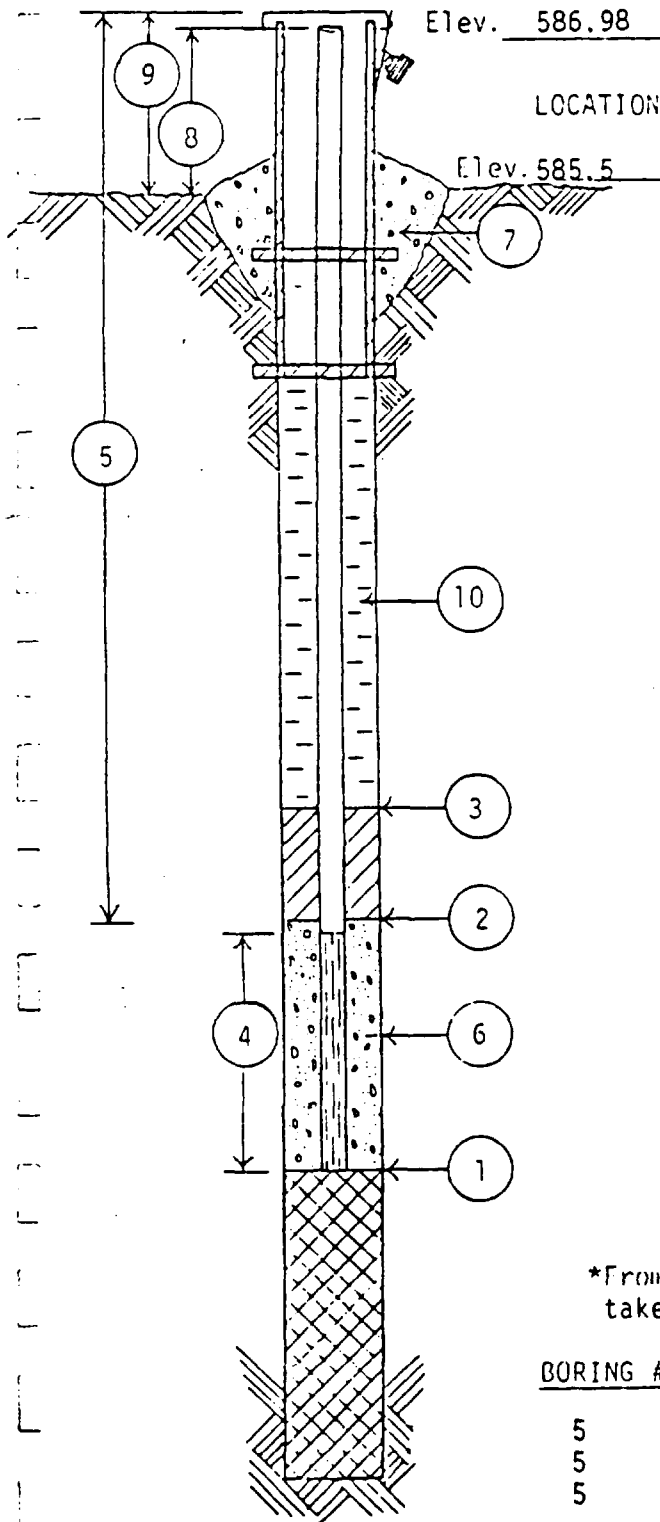


JOB NO. 8342

BORING NO. 5

DATE 7/25/79

CHIEF Jim Grieger



LOCATION OMC-Waukegan, Illinois

All depth measurements of well detail assumed to be from ground surface unless otherwise indicated.

- 1 DEPTH TO BOTTOM OF WELL POINT OR SLOTTED PIPE 9.0 FEET.
- 2 DEPTH OF BOTTOM OF SEAL (if installed) - FEET.
- 3 DEPTH TO TOP OF SEAL (if installed) - FEET.
- 4 LENGTH OF WELL POINT, PVC WELL SCREEN, OR SLOTTED PIPE 5.5 FEET. (Circle One)
- 5 TOTAL LENGTH OF PIPE 5 FEET @ 1 1/4 IN. DIAMETER.
- 6 TYPE OF FILTER MATERIAL AROUND WELL POINT OR SLOTTED PIPE Flint Sand.
- 7 CONCRETE CAP, YES NO (Circle One)
- 8 HEIGHT OF WELL CASING ABOVE GROUND 1.5 FEET.
- 9 PROTECTIVE CASING? YES NO (Circle One) HEIGHT ABOVE GROUND 3.4.
- 10 LOCKING CAP? YES NO (Circle One) TYPE OF BACKFILL: Flint Sand

#### WATER LEVEL CHECKS

\*From top of casing, if protective casing higher, take measurement from top of protective casing.

BORING #	DATE	TIME	DEPTH TO WATER	REMARKS
5	7/25/79		6.68	
5	7/26/79		6.65	
5	7/27/79		6.65	

JOB NO. 8342

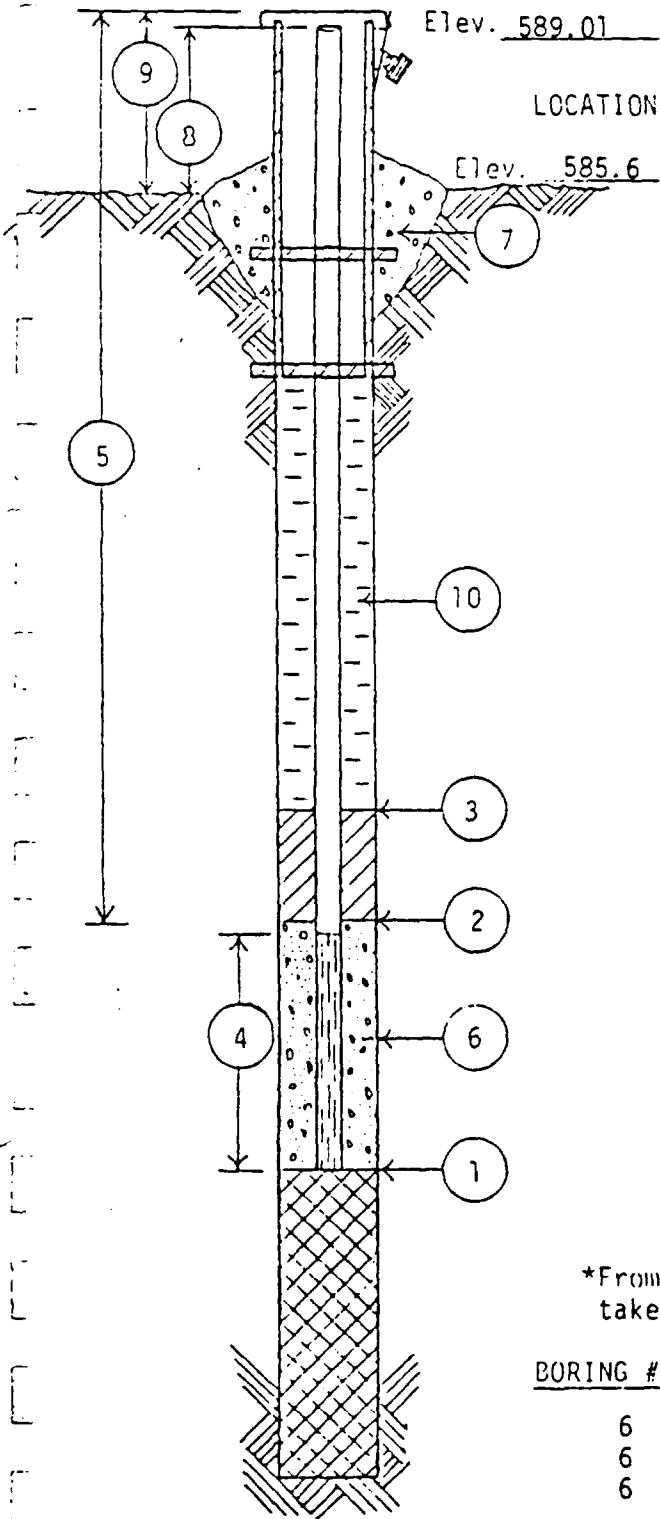
BORING NO. 6

DATE 7/25/79

CHIEF Jim Grieger

LOCATION OMC-Waukegan, Illinois

All depth measurements of well detail assumed to be from ground surface unless otherwise indicated.



- 1 DEPTH TO BOTTOM OF WELL POINT OR SLOTTED PIPE 9.6 FEET.
- 2 DEPTH OF BOTTOM OF SEAL (if installed) - FEET.
- 3 DEPTH TO TOP OF SEAL (if installed) - FEET.
- 4 LENGTH OF WELL POINT, PVC WELL SCREEN, OR SLOTTED PIPE 5.5 FEET. (Circle One)
- 5 TOTAL LENGTH OF PIPE 7.5 FEET @ 1 1/2 IN. DIAMETER.
- 6 TYPE OF FILTER MATERIAL AROUND WELL POINT OR SLOTTED PIPE Flint Sand.
- 7 CONCRETE CAP, YES NO (Circle One)
- 8 HEIGHT OF WELL CASING ABOVE GROUND 3.4 FEET.
- 9 PROTECTIVE CASING? YES NO (Circle One)  
HEIGHT ABOVE GROUND 3.3.
- 10 LOCKING CAP? YES NO (Circle One)  
TYPE OF BACKFILL: Flint Sand

#### WATER LEVEL CHECKS

\*From top of casing, if protective casing higher, take measurement from top of protective casing.

BORING #	DATE	TIME	DEPTH TO WATER	REMARKS
6	7/25/79		7.25	
6	7/26/79		7.22	
6	7/27/79		7.23	

WARZYN  
ENGINEERING & CONSTRUCTION, INC.



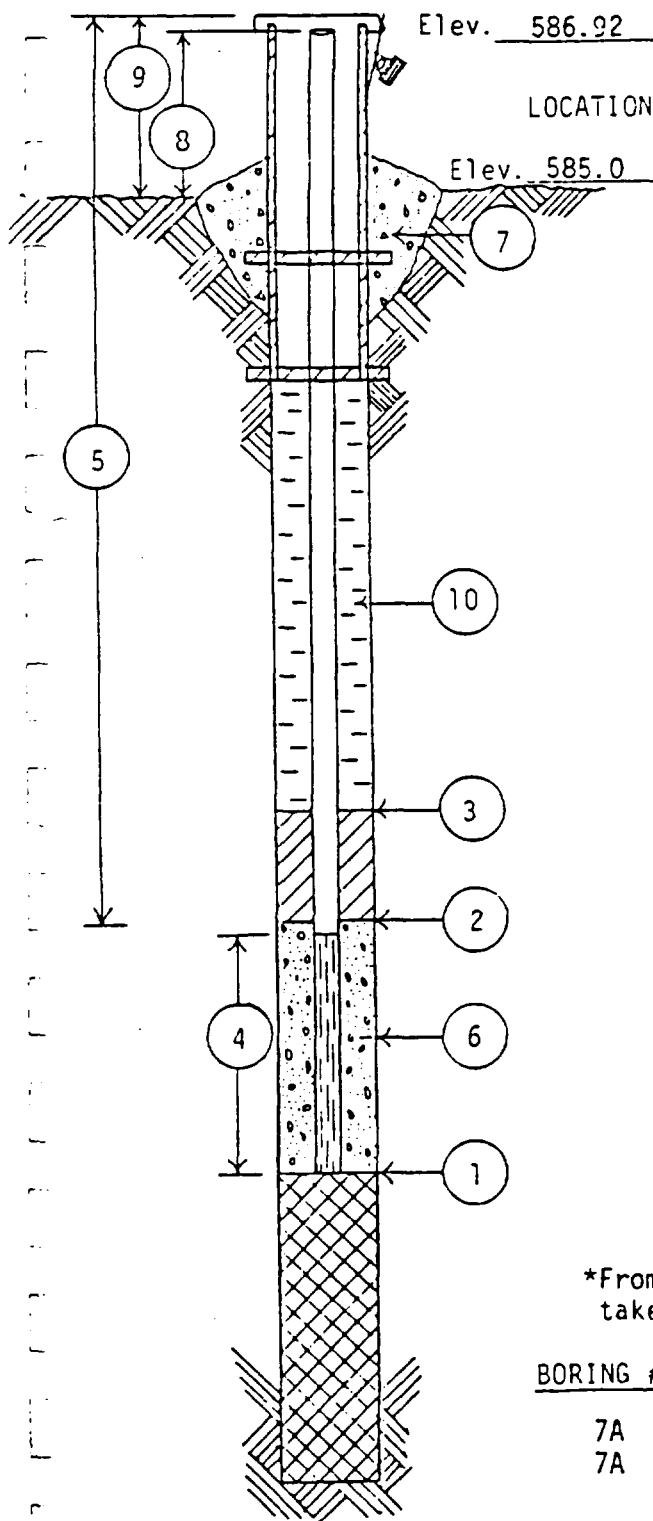
# PIEZOMETER DETAIL INFORMATION SHEET

JOB NO. 8342

BORING NO. 7A

DATE 7/26/79

CHIEF Jim Grieger



LOCATION OMC-Waukegan, Illinois

All depth measurements of well detail assumed to be from ground surface unless otherwise indicated.

- 1 DEPTH TO BOTTOM OF WELL POINT OR SLOTTED PIPE 8.6 FEET.
- 2 DEPTH OF BOTTOM OF SEAL (if installed) - FEET.
- 3 DEPTH TO TOP OF SEAL (if installed) - FEET.
- 4 LENGTH OF WELL POINT, PVC WELL SCREEN, OR SLOTTED PIPE 5.5 FEET. (Circle One)
- 5 TOTAL LENGTH OF PIPE 5 FEET @ 1 1/4 IN. DIAMETER.
- 6 TYPE OF FILTER MATERIAL AROUND WELL POINT OR SLOTTED PIPE Flint Sand.
- 7 CONCRETE CAP, YES NO (Circle One)
- 8 HEIGHT OF WELL CASING ABOVE GROUND 1.9 FEET.
- 9 PROTECTIVE CASING? YES NO (Circle One) HEIGHT ABOVE GROUND 2.5.
- 10 LOCKING CAP? YES NO (Circle One) TYPE OF BACKFILL: Flint Sand

## WATER LEVEL CHECKS

\*From top of casing, if protective casing higher, take measurement from top of protective casing.

BORING #	DATE	TIME	DEPTH TO WATER	REMARKS
7A	7/26/79		5.35	
7A	7/27/79		5.78	

JOB NO. 8342

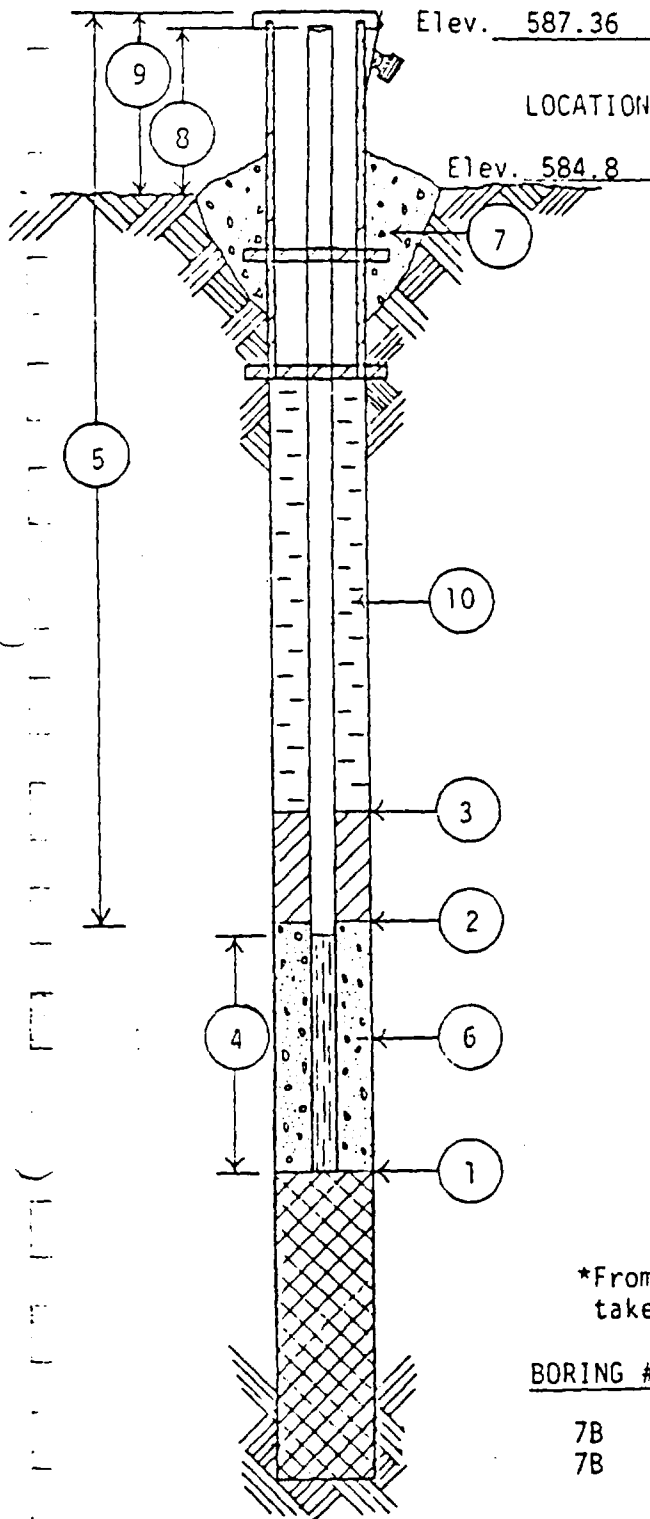
BORING NO. 7B

DATE 7/26/79

CHIEF Jim Grieger

LOCATION OMC-Waukegan, Illinois

All depth measurements of well detail assumed to be from ground surface unless otherwise indicated.



- 1 DEPTH TO BOTTOM OF WELL POINT OR SLOTTED PIPE 15.9 FEET.
- 2 DEPTH OF BOTTOM OF SEAL (if installed) 12 FEET.
- 3 DEPTH TO TOP OF SEAL (if installed) 9 FEET.
- 4 LENGTH OF WELL POINT PVC WELL SCREEN, OR SLOTTED PIPE 2.5 FEET. (Circle One)
- 5 TOTAL LENGTH OF PIPE 16 FEET @ 1 1/4 IN. DIAMETER.
- 6 TYPE OF FILTER MATERIAL AROUND WELL POINT OR SLOTTED PIPE Flint Sand.
- 7 CONCRETE CAP, YES NO (Circle One)
- 8 HEIGHT OF WELL CASING ABOVE GROUND 2.6 FEET.
- 9 PROTECTIVE CASING? YES NO (Circle One) HEIGHT ABOVE GROUND 3.0.
- 10 LOCKING CAP? YES NO (Circle One) TYPE OF BACKFILL: Flint Sand & Cave-in

#### WATER LEVEL CHECKS

\*From top of casing, if protective casing higher, take measurement from top of protective casing.

BORING #	DATE	TIME	DEPTH TO WATER	REMARKS
7B	7/26/79		5.63	
7B	7/27/79		6.04	

JOB NO. 8342

BORING NO. 7C

DATE 7/26/79

CHIEF Jim Grieger

LOCATION OMC-Waukegan, Illinois

All depth measurements of well detail assumed to be from ground surface unless otherwise indicated.

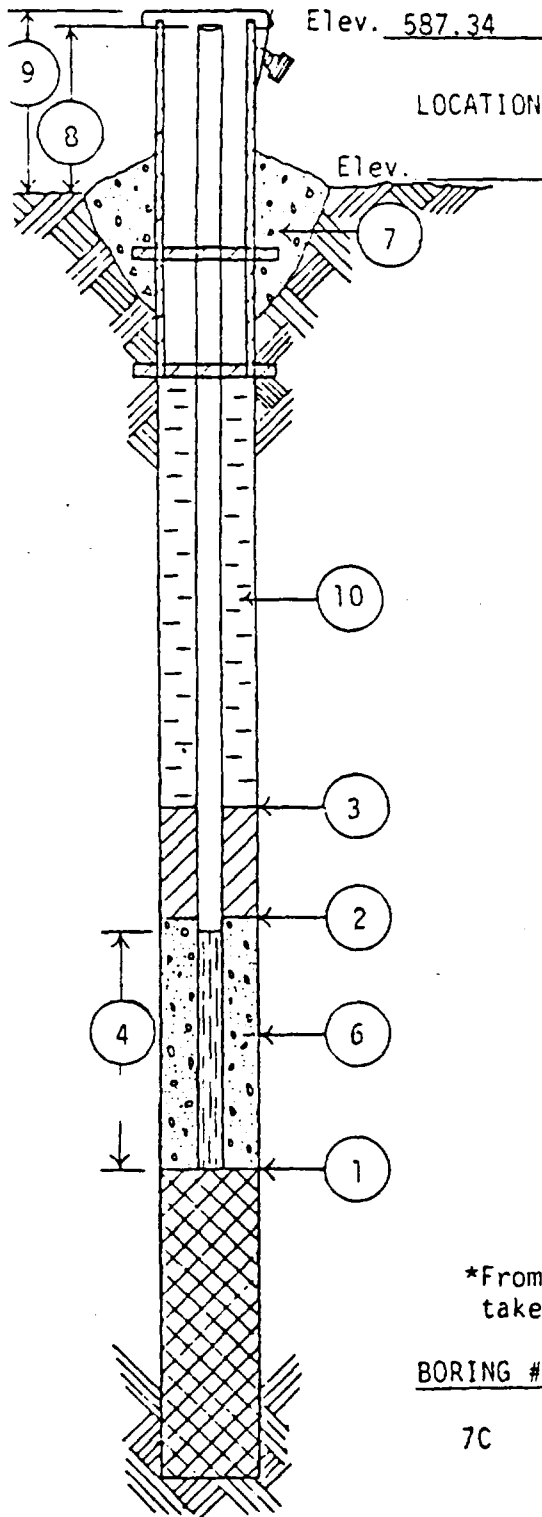
- ① DEPTH TO BOTTOM OF WELL POINT OR SLOTTED PIPE 22.6 FEET.
- ② DEPTH OF BOTTOM OF SEAL (if installed) 19 FEET.
- ③ DEPTH TO TOP OF SEAL (if installed) 16 FEET.
- ④ LENGTH OF WELL POINT, PVC WELL SCREEN, OR SLOTTED PIPE 2.5 FEET. (Circle One)
- ⑤ TOTAL LENGTH OF PIPE 22.5 FEET @ 1 1/2 IN. DIAMETER.
- ⑥ TYPE OF FILTER MATERIAL AROUND WELL POINT OR SLOTTED PIPE Flint Sand.
- ⑦ CONCRETE CAP, YES NO (Circle One)
- ⑧ HEIGHT OF WELL CASING ABOVE GROUND 2.4 FEET.
- ⑨ PROTECTIVE CASING? YES NO (Circle One)  
HEIGHT ABOVE GROUND 3.1.
- ⑩ LOCKING CAP? YES NO (Circle One)  
TYPE OF BACKFILL: Flint Sand & Cave-in

#### WATER LEVEL CHECKS

\*From top of casing, if protective casing higher, take measurement from top of protective casing.

BORING #	DATE	TIME	DEPTH TO WATER	REMARKS
7C	7/27/79		6.39	

WARZYN  
ENGINEERING INC.



# PIEZOMETER DETAIL INFORMATION SHEET

JOB NO. 8342

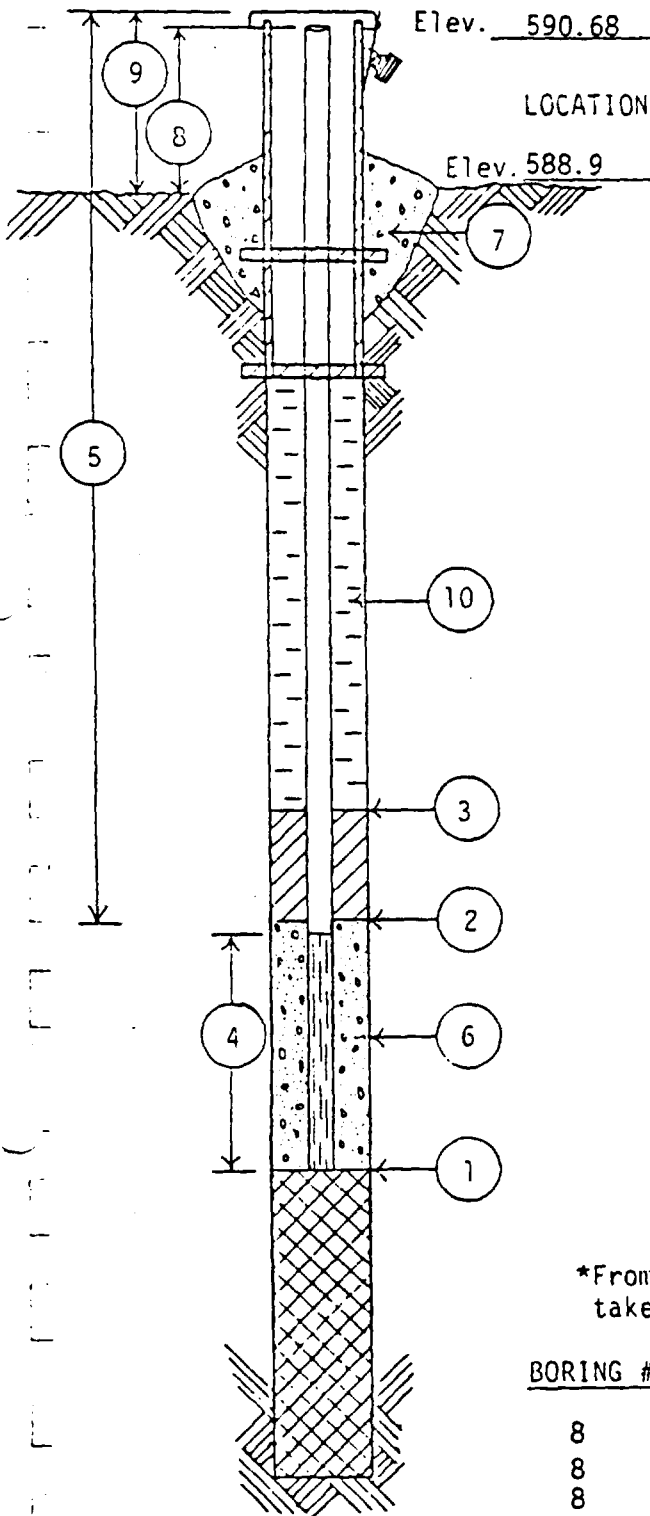
BORING NO. 8

DATE 7/17/79

CHIEF Jim Grieger

LOCATION OMC-Waukegan, Illinois

All depth measurements of well detail assumed to be from ground surface unless otherwise indicated.



- 1 DEPTH TO BOTTOM OF WELL POINT OR SLOTTED PIPE 8.7 FEET.
- 2 DEPTH OF BOTTOM OF SEAL (if installed) - FEET.
- 3 DEPTH TO TOP OF SEAL (if installed) - FEET.
- 4 LENGTH OF WELL POINT, PVC WELL SCREEN, OR SLOTTED PIPE 5.5 FEET. (Circle One)
- 5 TOTAL LENGTH OF PIPE 5 FEET @ 1 1/4 IN. DIAMETER.
- 6 TYPE OF FILTER MATERIAL AROUND WELL POINT OR SLOTTED PIPE Flint Sand.
- 7 CONCRETE CAP, YES NO (Circle One)
- 8 HEIGHT OF WELL CASING ABOVE GROUND 1.8 FEET.
- 9 PROTECTIVE CASING? YES NO (Circle One) HEIGHT ABOVE GROUND 2.4.
- 10 LOCKING CAP? YES NO (Circle One) TYPE OF BACKFILL: Flint Sand

## WATER LEVEL CHECKS

\*From top of casing, if protective casing higher, take measurement from top of protective casing.

BORING #	DATE	TIME	DEPTH TO WATER	REMARKS
8	7/17/79		6.78	
8	7/18/79		6.84	
8	7/19/79		6.88	

WARZYN  
ENGINEERING INC.



# PIEZOMETER DETAIL INFORMATION SHEET

JOB NO. 8342

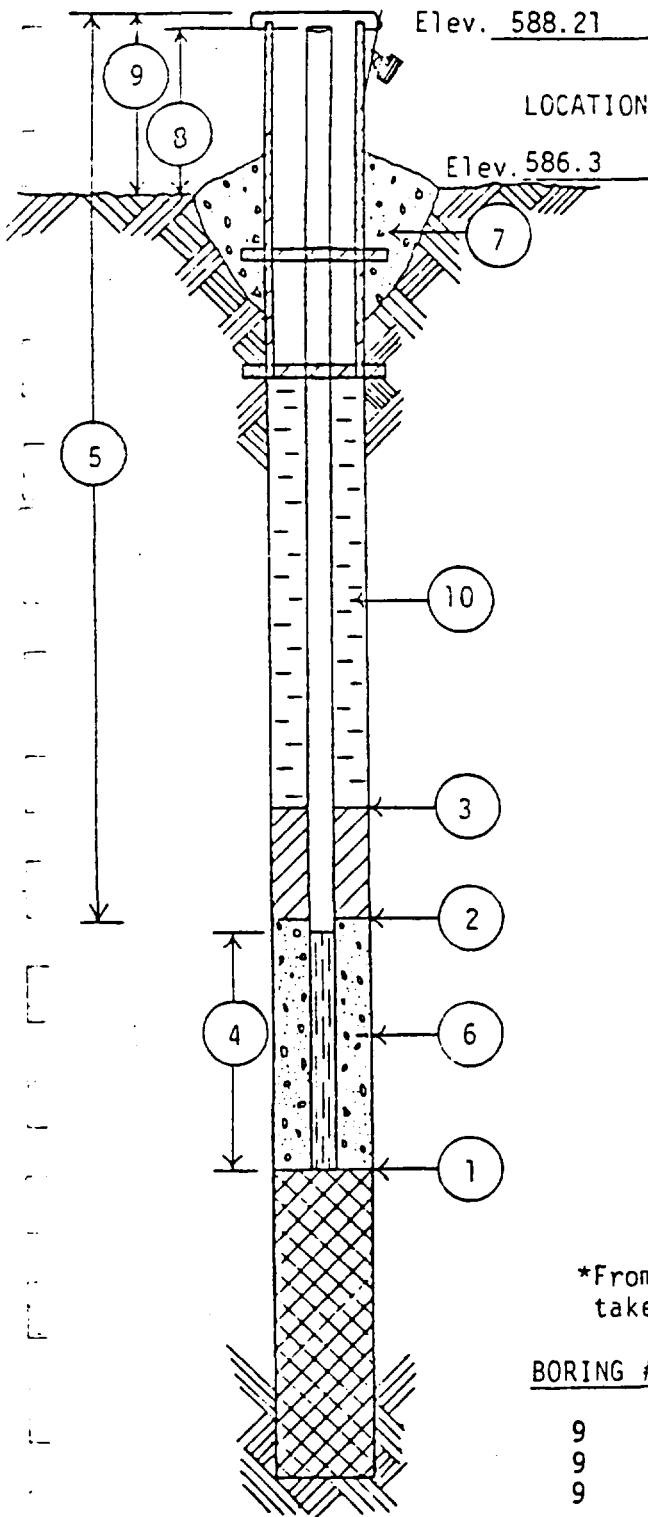
BORING NO. 9

DATE 7/17/79

CHIEF Jim Grieger

LOCATION OMC-Waukegan, Illinois

All depth measurements of well detail assumed to be from ground surface unless otherwise indicated.



- 1 DEPTH TO BOTTOM OF WELL POINT OR SLOTTED PIPE 8.6 FEET.
- 2 DEPTH OF BOTTOM OF SEAL (if installed) - FEET.
- 3 DEPTH TO TOP OF SEAL (if installed) - FEET.
- 4 LENGTH OF WELL POINT, PVC WELL SCREEN, OR SLOTTED PIPE 5.5 FEET. (Circle One)
- 5 TOTAL LENGTH OF PIPE 5 FEET  
Ø 1 1/4 IN. DIAMETER.
- 6 TYPE OF FILTER MATERIAL AROUND WELL POINT OR SLOTTED PIPE Flint Sand.
- 7 CONCRETE CAP, YES NO (Circle One)
- 8 HEIGHT OF WELL CASING ABOVE GROUND 1.9 FEET.
- 9 PROTECTIVE CASING? YES NO (Circle One)  
HEIGHT ABOVE GROUND 2.5.
- 10 LOCKING CAP? YES NO (Circle One)  
TYPE OF BACKFILL: Flint Sand

## WATER LEVEL CHECKS

\*From top of casing, if protective casing higher, take measurement from top of protective casing.

BORING #	DATE	TIME	DEPTH TO WATER	REMARKS
9	7/18/79		6.00	
9	7/19/79		5.97	
9	7/25/79		6.21	

APPENDIX D  
Baildown Permeability Test Data

# BAILDOWN TEST - FIELD FORM

1) Project: Hydrogeologic Investigation

2) Location: Waukegan, IL; OMC Plant

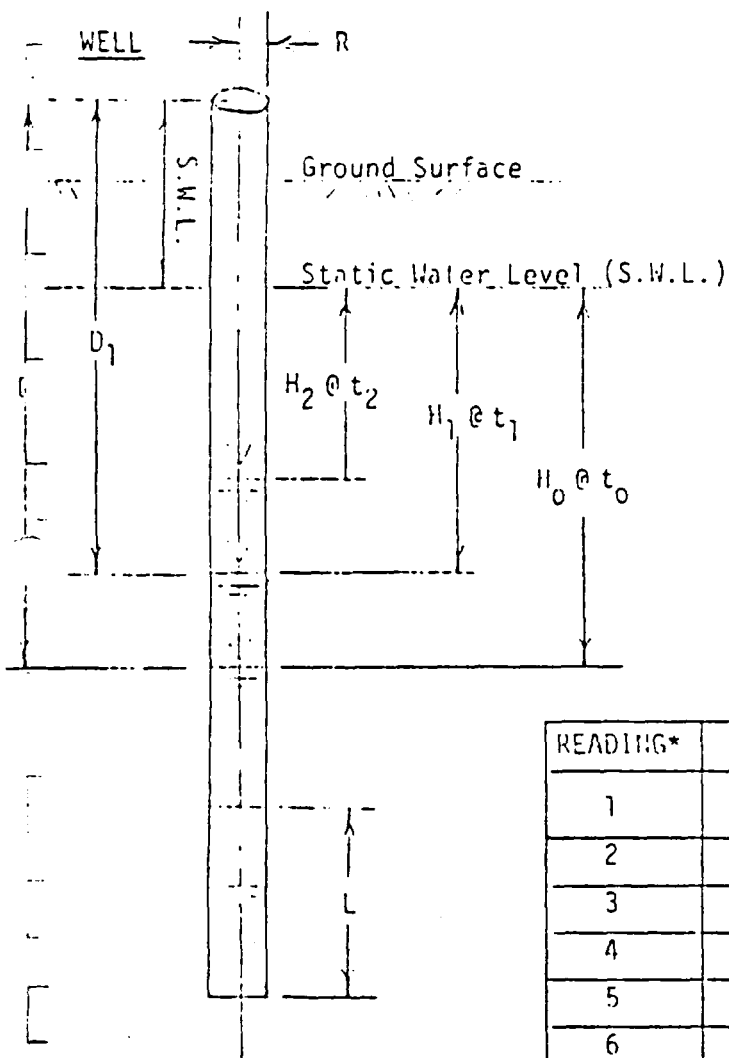
4) Job No: 8342

3) Client: JRB & Associates

5) Date: 7/20/79

6) Well or Boring No: 1

7) Personnel: Dan Hall



8) R=Radius of well= 0.625 (in.)

9) L=Length of Screen 5 (ft.)  
(from well detail sheet)

10) Static Water Level 5.75 (ft.)  
(Depth to Water)

11) Baildown Data (From Test)-Record  
Information in Minutes and Feet

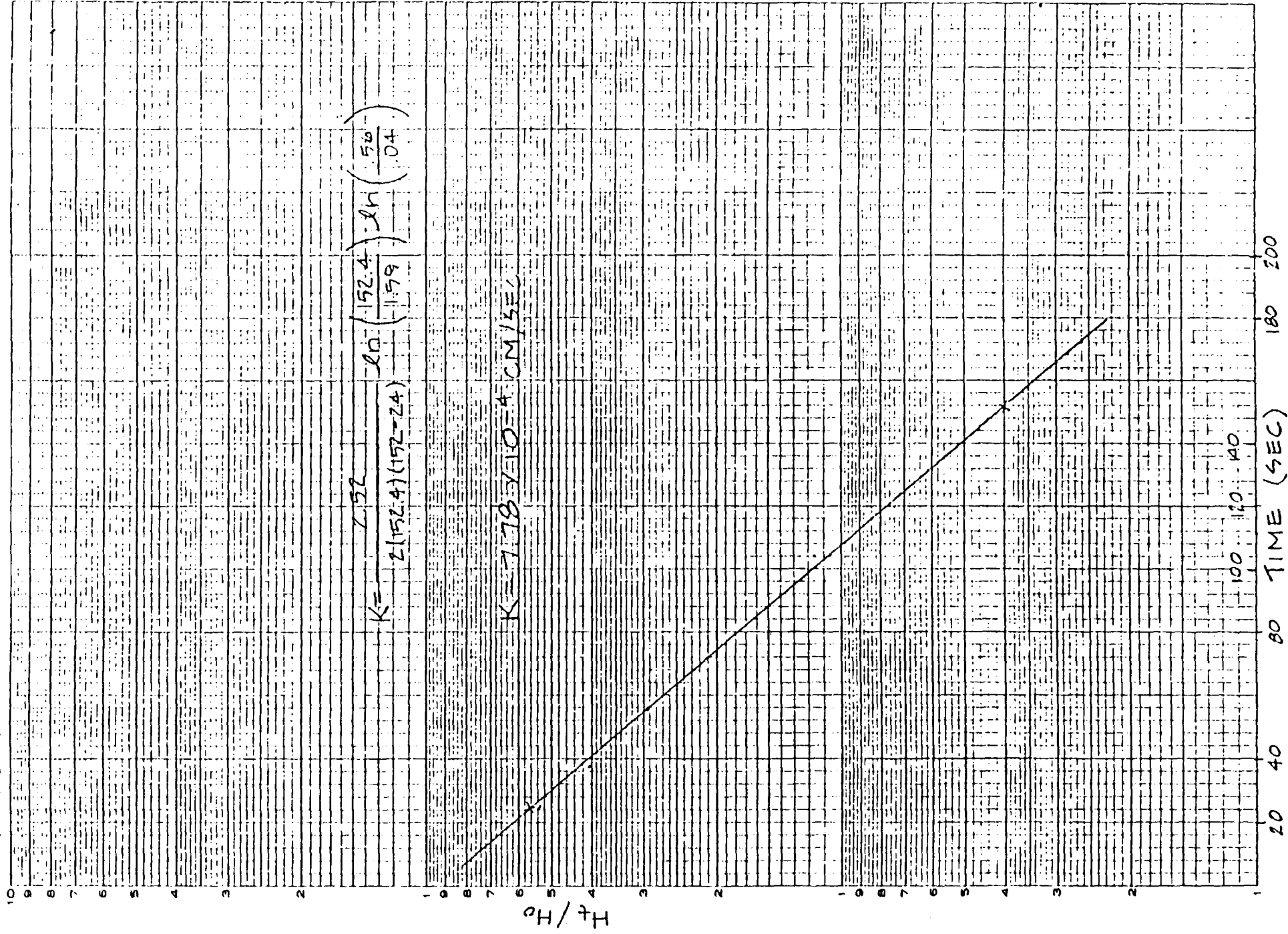
READING*	TIME (Start)	DEPTH TO WATER (After Baildown) $D_t$	$\frac{2+}{D_t - S.W.L. = H_t}$	$\frac{3+}{H_t/H_0}$
1	$t_0$ 0	$D_0$ 5.92	$H_0$ .170	1.00
2	$t_1$ 10	$D_1$ 5.88	$H_1$ .13	.765
3	$t_2$ 25	$D_2$ 5.84	$H_2$ .09	.529
4	$t_3$ 37	$D_3$ 5.82	$H_3$ .07	.412
5	$t_4$ 55	$D_4$ 5.80	$H_4$ .05	.294
6	$t_5$ 80	$D_5$ 5.79	$H_5$ .04	.235
7	$t_6$ 103	$D_6$ 5.77	$H_6$ .02	.118
8	$t_7$ 135	$D_7$ 5.76	$H_7$ .01	.059
9	$t_8$ 185	$D_8$ 5.75	$H_8$ 0	0
10	$t_9$	$D_9$	$H_9$	
11	$t_{10}$	$D_{10}$	$H_{10}$	
12	$t_{11}$	$D_{11}$	$H_{11}$	
13	$t_{12}$	$D_{12}$	$H_{12}$	
14	$t_{13}$	$D_{13}$	$H_{13}$	

\* Take readings until well is stabilized, if tight soils - test may be stopped prior to stabilization as necessary

+Disregard Columns 2 and 3 during baildown test. They are for office calculations.

$$K = \frac{R^2}{2L(t_2 - t_1)} \ln\left(\frac{L}{R}\right) \ln\left(\frac{H_1}{H_2}\right)$$

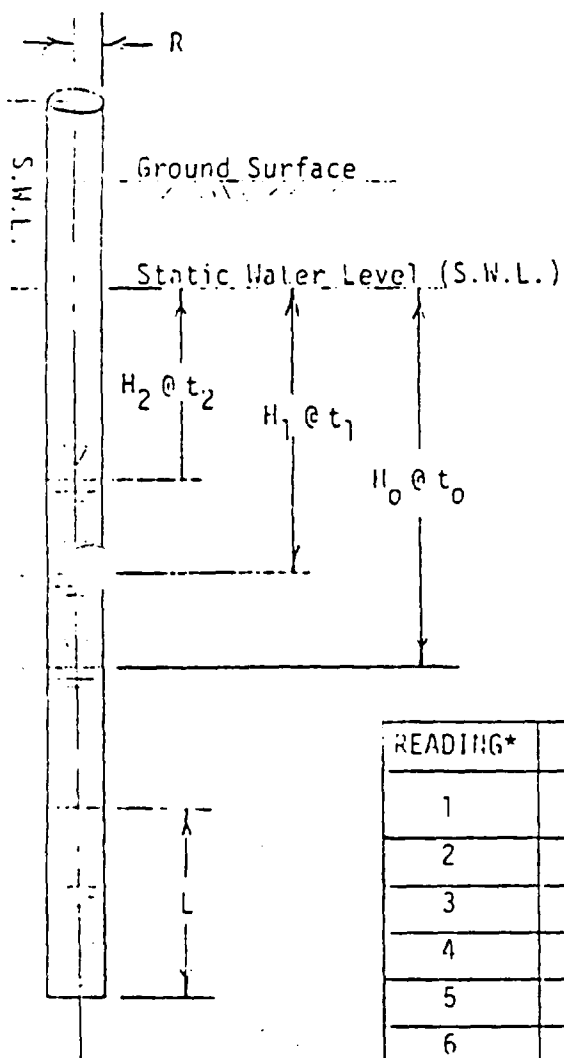
WELL #1



NO. 1  
SEMI-LOGARITHMIC  
3 CYCLES X 10 DIVISIONS PER INCH

# BAILDOWN TEST - FIELD FORM

1) Project: Hydrogeologic Investigation  
 2) Location: Waukegan, IL OMC Plant  
 3) Client: JRB & Associates  
 4) Job No: 8342  
 5) Date: 7/24/79  
 6) Well or Boring No: 2A  
 7) Personnel: Dan Hall



8) R=Radius of well= 0.625 (in.)  
 9) L=Length of Screen 5 (ft.)  
 (from well detail sheet)  
 10) Static Water Level 3.80 (ft.)  
 (Depth to Water)  
 11) Baildown Data (From Test)-Record  
 Information in Minutes and Feet

READING*	TIME (Start)	DEPTH TO WATER (After Baildown) $D_t$	<u>2+</u> $D_t - S.W.L. = H_t$	<u>3+</u> $H_t/H_0$
1	$t_0$	$D_0$	$H_0$	
2	$t_1$	$D_1$	$H_1$	
3	$t_2$	$D_2$	$H_2$	
4	$t_3$	$D_3$	$H_3$	
5	$t_4$	$D_4$	$H_4$	
6	$t_5$	$D_5$	$H_5$	
7	$t_6$	$D_6$	$H_6$	
8	$t_7$	$D_7$	$H_7$	
9	$t_8$	$D_8$	$H_8$	
10	$t_9$	$D_9$	$H_9$	
11	$t_{10}$	$D_{10}$	$H_{10}$	
12	$t_{11}$	$D_{11}$	$H_{11}$	
13	$t_{12}$	$D_{12}$	$H_{12}$	
14	$t_{13}$	$D_{13}$	$H_{13}$	

Take readings until well is stabilized, if tight soils - test may be stopped prior to stabilization as necessary

Disregard Columns 2 and 3 during baildown test. They are for office calculations.

$$K = \frac{R^2}{2L(t_2 - t_1)} \ln\left(\frac{L}{R}\right) \ln\left(\frac{H_1}{H_2}\right)$$

# BAILDOWN TEST - FIELD FORM

1) Project: Hydrogeologic Investigation

2) Location: Waukegan, IL OMC Plant

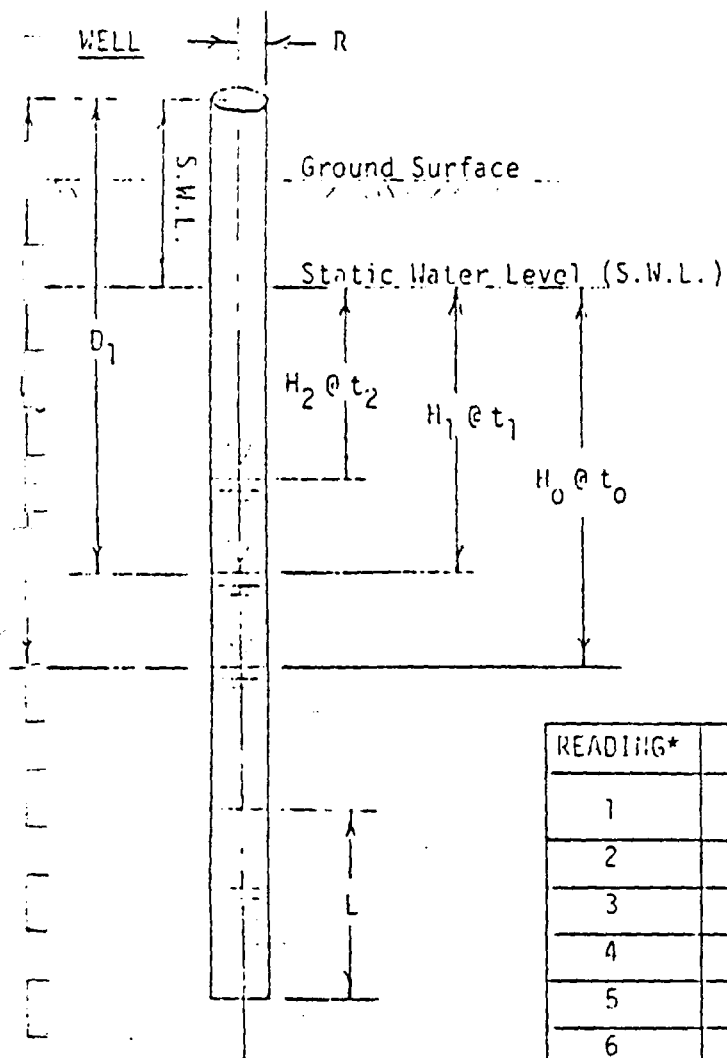
4) Job No: 8342

3) Client: JRB & Associates

5) Date: 7/24/79

6) Well or Boring No: 2B

7) Personnel: Dan Hall



8) R=Radius of well= 0.625 (in.)

9) L=Length of Screen 2 (ft.)  
(from well detail sheet)

10) Static Water Level 4.45 (ft.)  
(Depth to Water)

11) Baildown Data (From Test)-Record  
Information in Minutes and Feet

READING*	TIME (Start)	DEPTH TO WATER (After Baildown) $D_t$	$D_t - S.W.L. = H_t$	$H_t/H_0$
1	$t_0$	$D_0$	$H_0$	
2	$t_1$	$D_1$	$H_1$	
3	$t_2$	$D_2$	$H_2$	
4	$t_3$	$D_3$	$H_3$	
5	$t_4$	$D_4$	$H_4$	
6	$t_5$ 0	$D_5$ 6.2	$H_5$ 1.75	1
7	$t_6$ 10	$D_6$ 5.8	$H_6$ 1.35	.771
8	$t_7$ 26	$D_7$ 4.5	$H_7$ .05	.029
9	$t_8$ 48	$D_8$ 4.45	$H_8$ 0	0
10	$t_9$	$D_9$	$H_9$	
11	$t_{10}$	$D_{10}$	$H_{10}$	
12	$t_{11}$	$D_{11}$	$H_{11}$	
13	$t_{12}$	$D_{12}$	$H_{12}$	
14	$t_{13}$	$D_{13}$	$H_{13}$	

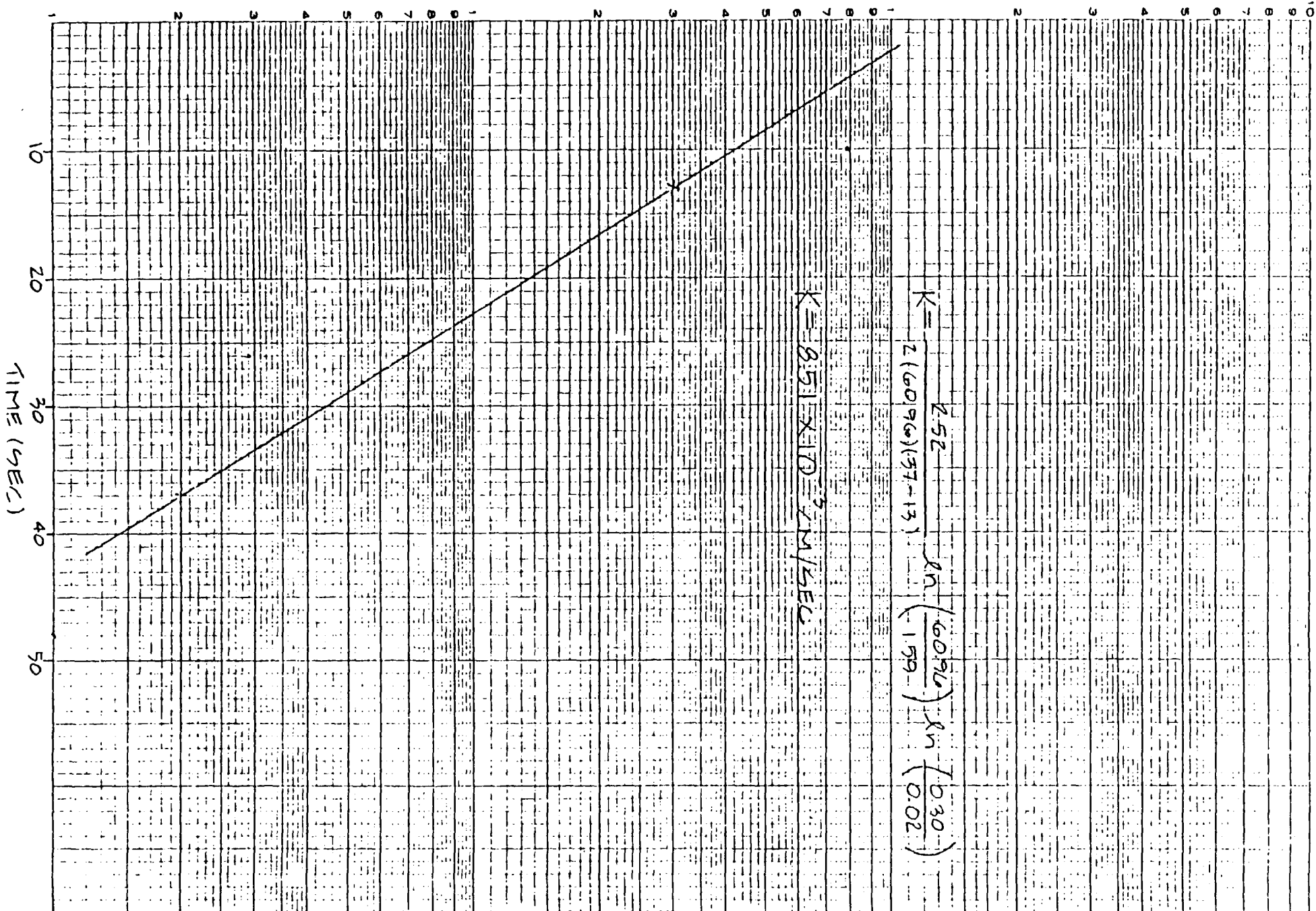
\* Take readings until well is stabilized, if tight soils - test may be stopped prior to stabilization as necessary

+Disregard Columns 2 and 3 during baildown test. They are for office calculations.

$$K = \frac{R^2}{2L(t_2 - t_1)} \ln\left(\frac{L}{R}\right) \ln\left(\frac{H_1}{H_2}\right)$$

$H_t / H_o$

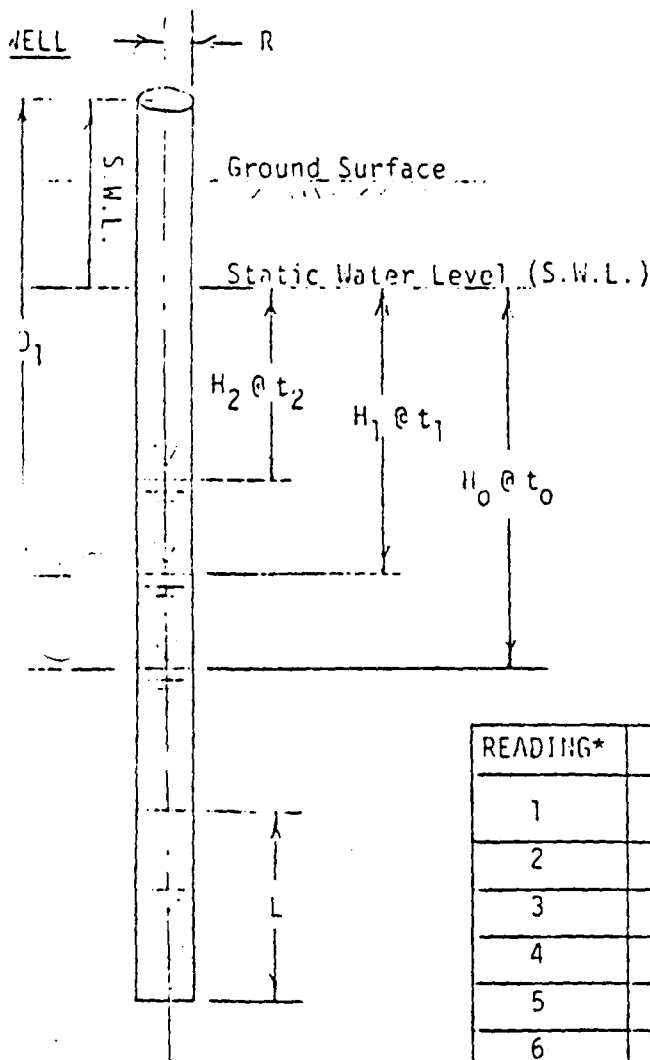
WELL #23



- 1) Project: Hydrogeologic Investigation  
 2) Location: Waukegan, IL - OMC Plant  
 3) Client: JRB & Associates

4) Job No: 8342  
 5) Date: 7/24/79

- 6) Well or Boring No: 2C  
 7) Personnel: Dan Hall



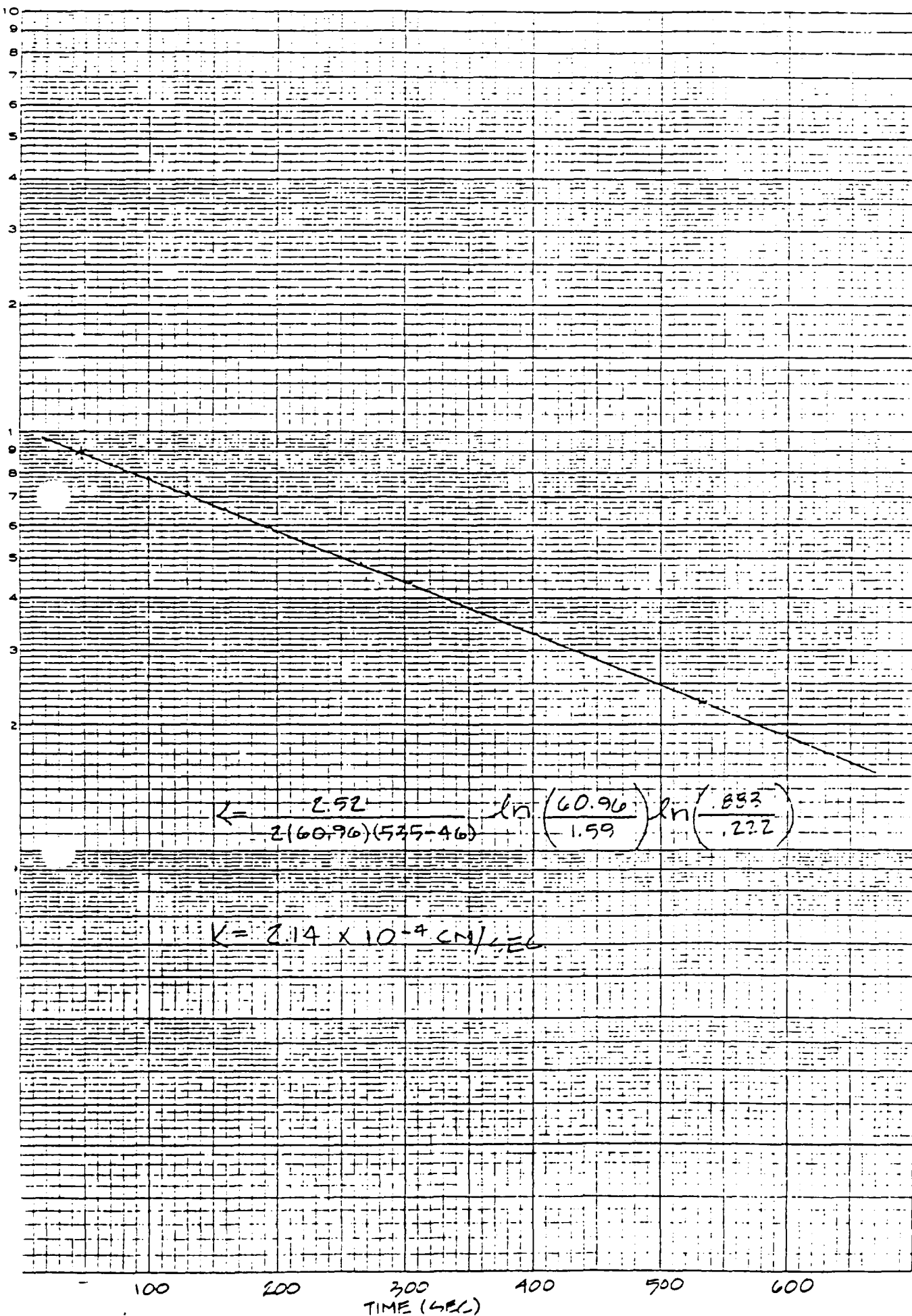
- 8) R=Radius of well= 0.625 (in.)  
 9) L=Length of Screen 2 (ft.)  
 (from well detail sheet)  
 10) Static Water Level 4.92 (ft.)  
 (Depth to Water)  
 11) Baildown Data (From Test)-Record  
 Information in Minutes and Feet

READING*	TIME (Start)	DEPTH TO WATER (After Baildown) D <sub>t</sub>	2 <sup>+</sup> D <sub>t</sub> - S.W.L. = H <sub>t</sub>	3 <sup>+</sup> H <sub>t</sub> /H <sub>0</sub>
1	t <sub>0</sub> 0	D <sub>0</sub> 14.30	H <sub>0</sub> 9.38	1
2	t <sub>1</sub> 20	D <sub>1</sub> 13.75	H <sub>1</sub> 8.83	.941
3	t <sub>2</sub> 46	D <sub>2</sub> 13.2	H <sub>2</sub> 8.28	.883
4	t <sub>3</sub> 75	D <sub>3</sub> 12.65	H <sub>3</sub> 7.73	.824
5	t <sub>4</sub> 100	D <sub>4</sub> 12.10	H <sub>4</sub> 7.18	.765
6	t <sub>5</sub> 130	D <sub>5</sub> 11.50	H <sub>5</sub> 6.58	.701
7	t <sub>6</sub> 160	D <sub>6</sub> 11.00	H <sub>6</sub> 6.08	.648
8	t <sub>7</sub> 193	D <sub>7</sub> 10.5	H <sub>7</sub> 5.58	.595
9	t <sub>8</sub> 265	D <sub>8</sub> 9.5	H <sub>8</sub> 4.58	.488
10	t <sub>9</sub> 305	D <sub>9</sub> 9	H <sub>9</sub> 4.08	.435
11	t <sub>10</sub> 402	D <sub>10</sub> 8	H <sub>10</sub> 3.08	.328
12	t <sub>11</sub> 535	D <sub>11</sub> 7	H <sub>11</sub> 2.08	.222
13	t <sub>12</sub> 723	D <sub>12</sub> 6	H <sub>12</sub> 1.08	.115
14	t <sub>13</sub> 1202	D <sub>13</sub> 5	H <sub>13</sub> .08	.009

\* Take readings until well is stabilized, if tight soils - test may be stopped prior to stabilization as necessary

+Disregard Columns 2 and 3 during baildown test. They are for office calculations.

$$K = \frac{R^2}{2L(t_2 - t_1)} \ln\left(\frac{L}{R}\right) \ln\left(\frac{H_1}{H_2}\right)$$



$$k = \frac{2.52}{2(60.96)(535-46)} \ln \left( \frac{60.96}{1.59} \right) \ln \left( \frac{.893}{.222} \right)$$

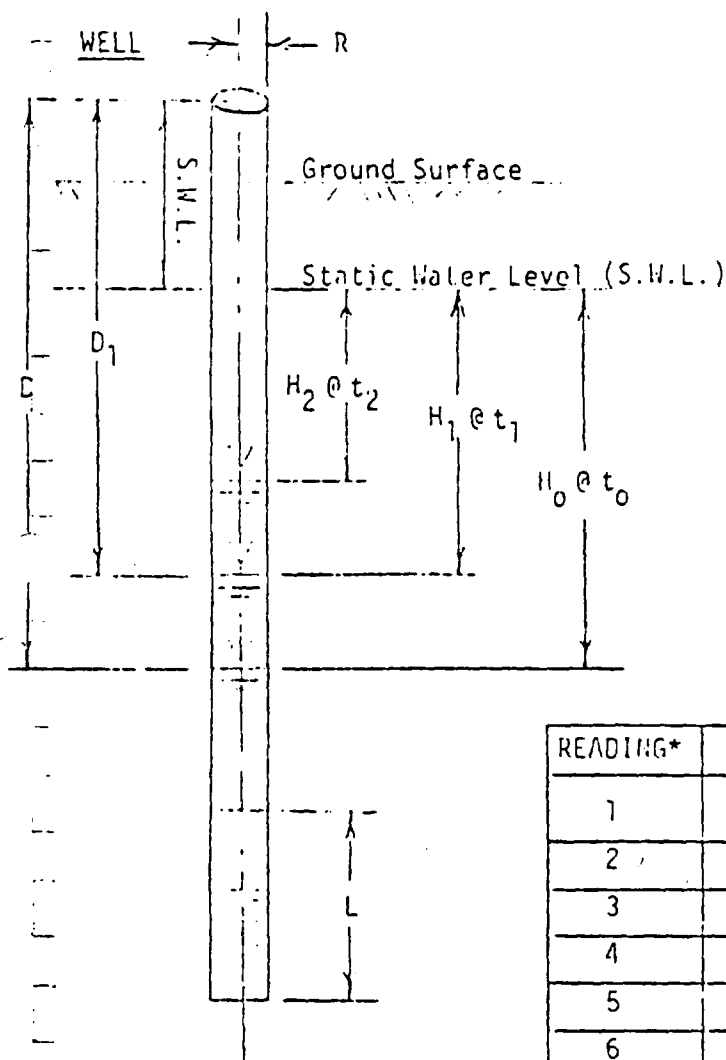
$$k = 2.14 \times 10^{-4} \text{ CM/SEC}$$

# BAILDOWN TEST - FIELD FORM

- 1) Project: Hydrogeologic Investigation
- 2) Location: Waukegan, IL; OMC Plant
- 3) Client: JRB & Associates
- 4) Job No: 8342
- 5) Date: 7/24/79

- 6) Well or Boring No: 3
- 7) Personnel: Dan Hall

- 8) R=Radius of well= 0.625 (in.)
- 9) L=Length of Screen 5 (ft.)  
(from well detail sheet)
- 10) Static Water Level 11.77 (ft.)  
(Depth to Water)
- 11) Baildown Data (From Test)-Record  
Information in Minutes and Feet



READING*	TIME (Start)	DEPTH TO WATER (After Baildown) D <sub>t</sub>	2 <sup>+</sup>	
			D <sub>t</sub> - S.W.L. = H <sub>t</sub>	H <sub>t</sub> /H <sub>0</sub>
1	t <sub>0</sub> 0	D <sub>0</sub> 12.11	H <sub>0</sub> .34	1
2	t <sub>1</sub> 37	D <sub>1</sub> 12.05	H <sub>1</sub> .28	.824
3	t <sub>2</sub> 60	D <sub>2</sub> 11.95	H <sub>2</sub> .18	.529
4	t <sub>3</sub> 92	D <sub>3</sub> 11.90	H <sub>3</sub> .13	.382
5	t <sub>4</sub> 190	D <sub>4</sub> 11.85	H <sub>4</sub> .08	.235
6	t <sub>5</sub> 330	D <sub>5</sub> 11.82	H <sub>5</sub> .05	.147
7	t <sub>6</sub> 435	D <sub>6</sub> 11.80	H <sub>6</sub> .03	.088
8	t <sub>7</sub>	D <sub>7</sub>	H <sub>7</sub>	
9	t <sub>8</sub>	D <sub>8</sub>	H <sub>8</sub>	
10	t <sub>9</sub>	D <sub>9</sub>	H <sub>9</sub>	
11	t <sub>10</sub>	D <sub>10</sub>	H <sub>10</sub>	
12	t <sub>11</sub>	D <sub>11</sub>	H <sub>11</sub>	
13	t <sub>12</sub>	D <sub>12</sub>	H <sub>12</sub>	
14	t <sub>13</sub>	D <sub>13</sub>	H <sub>13</sub>	

\* Take readings until well is stabilized, if tight soils - test may be stopped prior to stabilization as necessary

+Disregard Columns 2 and 3 during baildown test. They are for office calculations.

$$K = \frac{R^2}{2L(t_2 - t_1)} \ln\left(\frac{L}{R}\right) \ln\left(\frac{H_1}{H_2}\right)$$

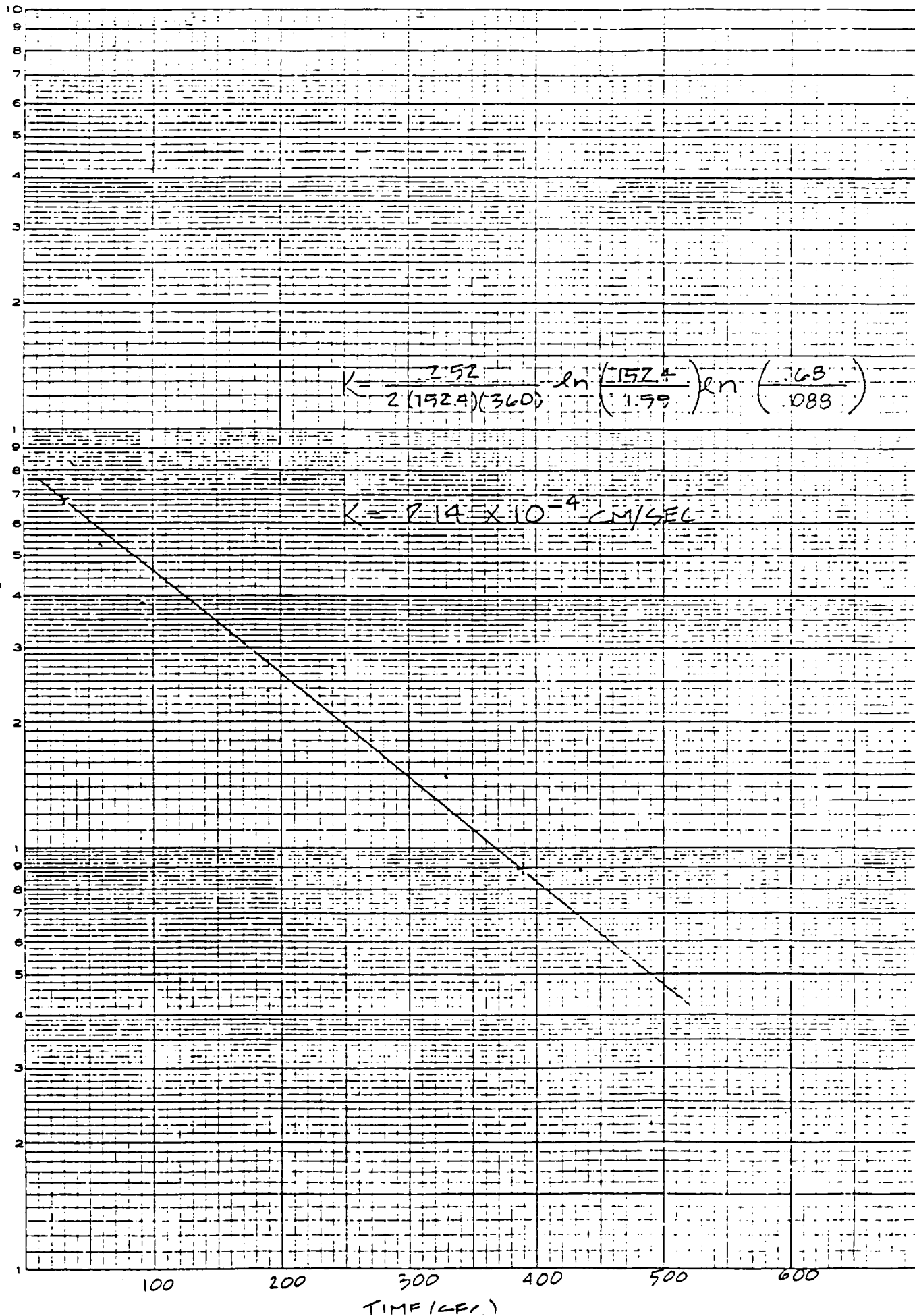
WELL 7

DIETZ CORPORATION

GEN. GRAPH PAPER

NO. 1310  
3 CYCLES X 10 DIVISIONS PER INCH

$H_t/H_0$



1) Project: Hydrogeologic Investigation

2) Location: Waukegan, IL; OMC Plant

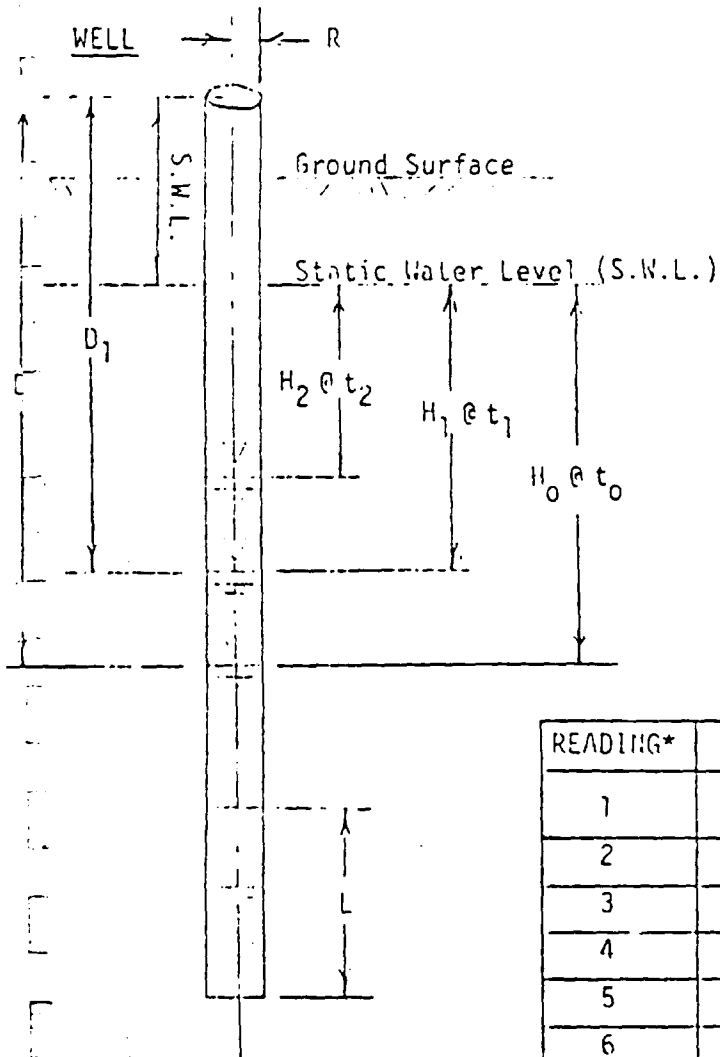
4) Job No: 8342

3) Client: JRB & Associates

5) Date: 7/25/79

6) Well or Boring No: 4A

7) Personnel: Dan Hall



8) R=Radius of well= 0.625 (in.)

9) L=Length of Screen 5 (ft.)  
(from well detail sheet)

10) Static Water Level 4.42 (ft.)  
(Depth to Water)

11) Baildown Data (From Test)-Record  
Information in Minutes and Feet

Test 1 5gal/1:26

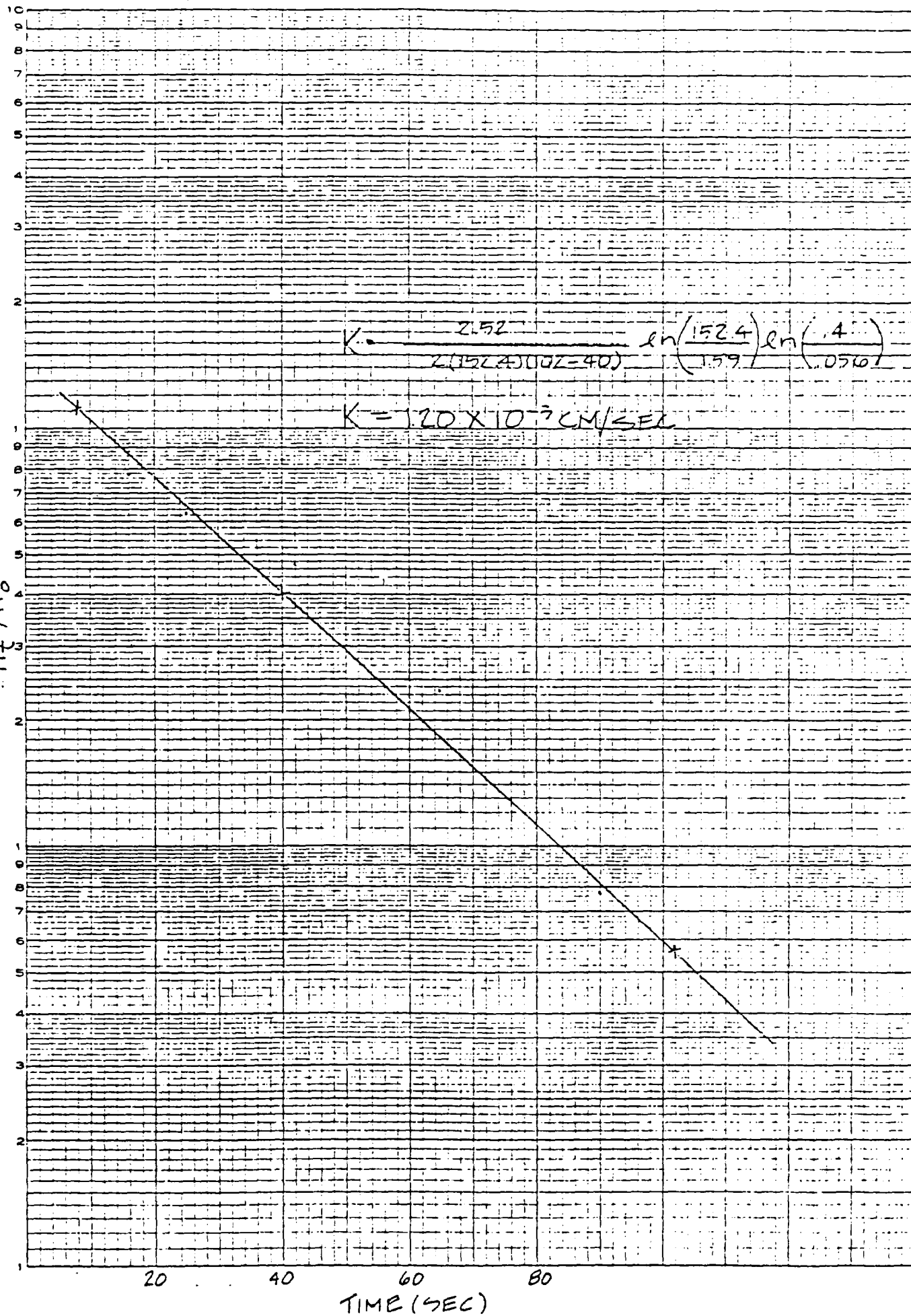
Test 2 5gal/1:26

READING*	TIME (Start)	DEPTH TO WATER (After Baildown) $D_t$	2+	3+
			$D_t - S.W.L. = H_t$	$H_t/H_0$
1	$t_0$ 0	$D_0$ 4.55	$H_0$ .13	1
2	$t_1$ 16	$D_1$ 4.52	$H_1$ .10	.769
3	$t_2$ 25	$D_2$ 4.50	$H_2$ .08	.615
4	$t_3$ 42	$D_3$ 4.48	$H_3$ .06	.462
5	$t_4$ 65	$D_4$ 4.45	$H_4$ .03	.231
6	$t_5$ 90	$D_5$ 4.43	$H_5$ .01	.077
7	$t_6$ 102	$D_6$ 4.42	$H_6$ 0	0
8	$t_7$	$D_7$	$H_7$	
9	$t_8$	$D_8$	$H_8$	
10	$t_9$	$D_9$	$H_9$	
11	$t_{10}$	$D_{10}$	$H_{10}$	
12	$t_{11}$	$D_{11}$	$H_{11}$	
13	$t_{12}$	$D_{12}$	$H_{12}$	
14	$t_{13}$	$D_{13}$	$H_{13}$	

\* Take readings until well is stabilized, if tight soils - test may be stopped prior to stabilization as necessary

+Disregard Columns 2 and 3 during baildown test. They are for office calculations.

$$K = \frac{R^2}{2L(t_2 - t_1)} \ln\left(\frac{L}{R}\right) \ln\left(\frac{H_1}{H_2}\right)$$

$$H_T/H_0$$


# BAILDOWN TEST - FIELD FORM

1) Project: Hydrogeologic Investigation

2) Location: Waukegan - OMC Plant

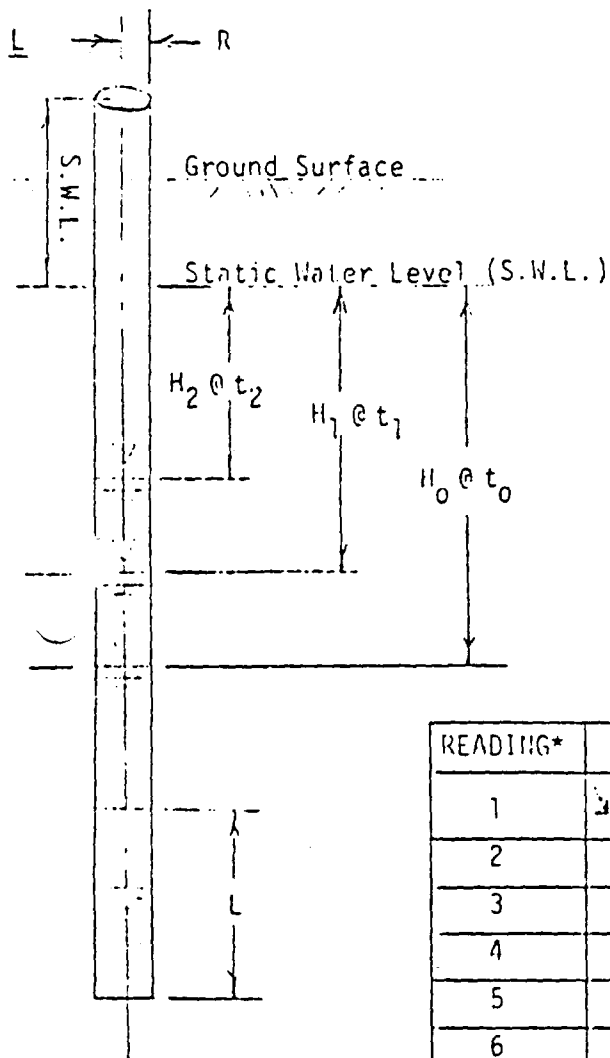
4) Job No: 8342

3) Client: JRB & Associates

5) Date: 7/25/79

6) Well or Boring No: 48

7) Personnel: Dan Hall



8) R=Radius of well= 1.25/2 0.625 (in.)

9) L=Length of Screen 2 (ft.)  
(from well detail sheet)

10) Static Water Level 4.97 (ft.)  
(Depth to Water)

11) Baildown Data (From Test)-Record  
Information in Minutes and Feet

READING*	TIME (Start)	DEPTH TO WATER (After Baildown) $D_t$	$D_t - S.W.L. = H_t$	$H_t/H_0$
1	$t_0$ 0	$D_0$ 6.3	$H_0$ 1.33	1
2	$t_1$ 17	$D_1$ 5.2	$H_1$ .23	.173
3	$t_2$ 29	$D_2$ 5.1	$H_2$ .13	.098
4	$t_3$ 54	$D_3$ 5.05	$H_3$ .08	.060
5	$t_4$ 92	$D_4$ 5.03	$H_4$ .06	.045
6	$t_5$ 165	$D_5$ 5.02	$H_5$ .05	.038
7	$t_6$ 190	$D_6$ 5.01	$H_6$ .04	.030
8	$t_7$ 404	$D_7$ 5.00	$H_7$ .03	.023
9	$t_8$	$D_8$	$H_8$	
10	$t_9$	$D_9$	$H_9$	
11	$t_{10}$	$D_{10}$	$H_{10}$	
12	$t_{11}$	$D_{11}$	$H_{11}$	
13	$t_{12}$	$D_{12}$	$H_{12}$	
14	$t_{13}$	$D_{13}$	$H_{13}$	

\* Take readings until well is stabilized, if tight soils - test may be stopped prior to stabilization as necessary

+Disregard Columns 2 and 3 during baildown test. They are for office calculations.

$$K = \frac{R^2}{2L(t_2 - t_1)} \ln\left(\frac{L}{R}\right) \ln\left(\frac{H_1}{H_2}\right)$$

WELL # 4B

DIETARY CONCENTRATION

NO. 310  
SEMILOG  
3 CYCLES X 10  
SIGNS PER INCH

$H_t/H_0$

a

$$K = \frac{2.5Z}{2(60.96)(80-20)} \ln \left( \frac{60.69}{1.59} \right) \ln \left( \frac{0.21}{0.044} \right)$$

$$K = 7.3 \times 10^{-4} \text{ CM/SEC}$$

b

$$K = \frac{2.5Z}{2(60.96)(90-65)} \ln \frac{60.69}{1.59} \ln \frac{0.038}{0.030}$$

$$K = 1.90 \times 10^{-3} \text{ CM/SEC}$$

TIME (SEC)

# BAILDOWN TEST - FIELD FORM

1) Project: Hydrogeologic Investigation

2) Location: Waukegan, IL: OMC Plant

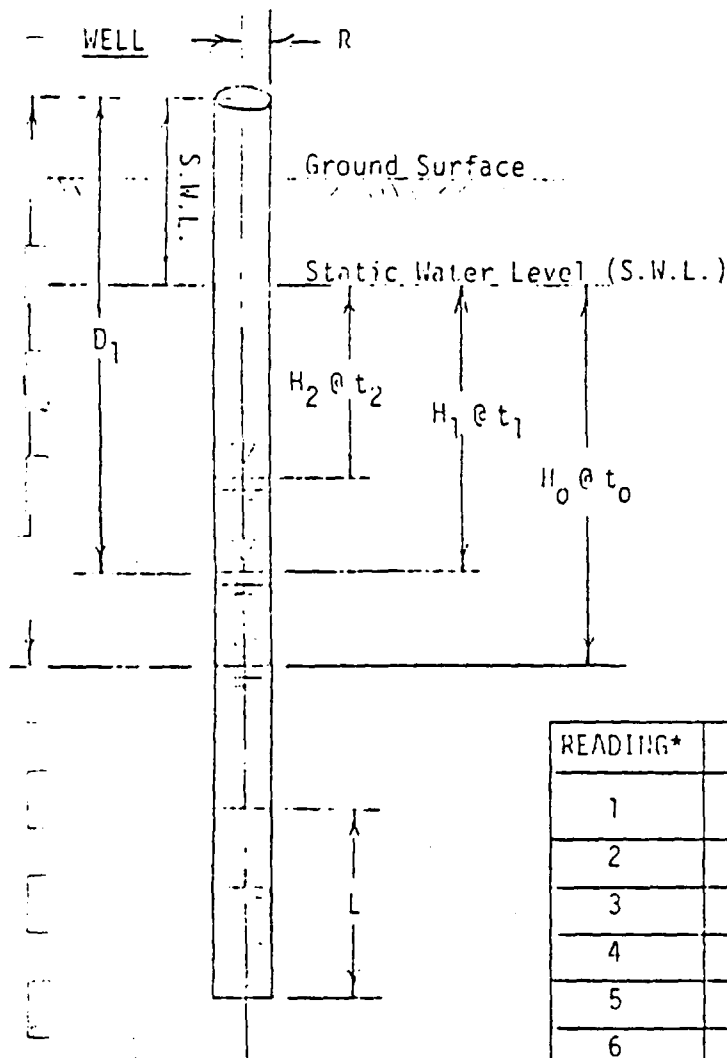
4) Job No: 8342

3) Client: JRB & Associates

5) Date: 7/25/79

6) Well or Boring No: 4C

7) Personnel: Dan Hall



8) R=Radius of well= 0.625 (in.)

9) L=Length of Screen 2 (ft.)  
(from well detail sheet)

10) Static Water Level 5.72 (ft.)  
(Depth to Water)

11) Baildown Data (From Test)-Record  
Information in Minutes and Feet

READING*	TIME (Start)	DEPTH TO WATER (After Baildown) $D_t$	2+		3+
			$D_t - S.W.L. = H_t$		$H_t/H_0$
1	$t_0$	$D_0$ 879	$H_0$ 3.07		1
2	$t_1$ 20	$D_1$ 7.0	$H_1$ 1.28		.417
3	$t_2$ 25	$D_2$ 6.9	$H_2$ 1.18		.384
4	$t_3$ 37	$D_3$ 6.2	$H_3$ .48		.156
5	$t_4$ 43	$D_4$ 6.1	$H_4$ .38		.124
6	$t_5$ 54	$D_5$ 6.05	$H_5$ .33		.107
7	$t_6$ 60	$D_6$ 6.0	$H_6$ .28		.091
8	$t_7$ 70	$D_7$ 5.95	$H_7$ .23		.075
9	$t_8$ 82	$D_8$ 5.90	$H_8$ .18		.059
10	$t_9$ 110	$D_9$ 5.85	$H_9$ .13		.042
11	$t_{10}$ 132	$D_{10}$ 5.80	$H_{10}$ .08		.026
12	$t_{11}$ 236	$D_{11}$ 5.75	$H_{11}$ .03		.010
13	$t_{12}$ 305	$D_{12}$ 5.74	$H_{12}$ .02		.007
14	$t_{13}$ 330	$D_{13}$ 5.73	$H_{13}$ .01		.003

\* Take readings until well is stabilized, if tight soils - test may be stopped prior to stabilization as necessary

+Disregard Columns 2 and 3 during baildown test. They are for office calculations.

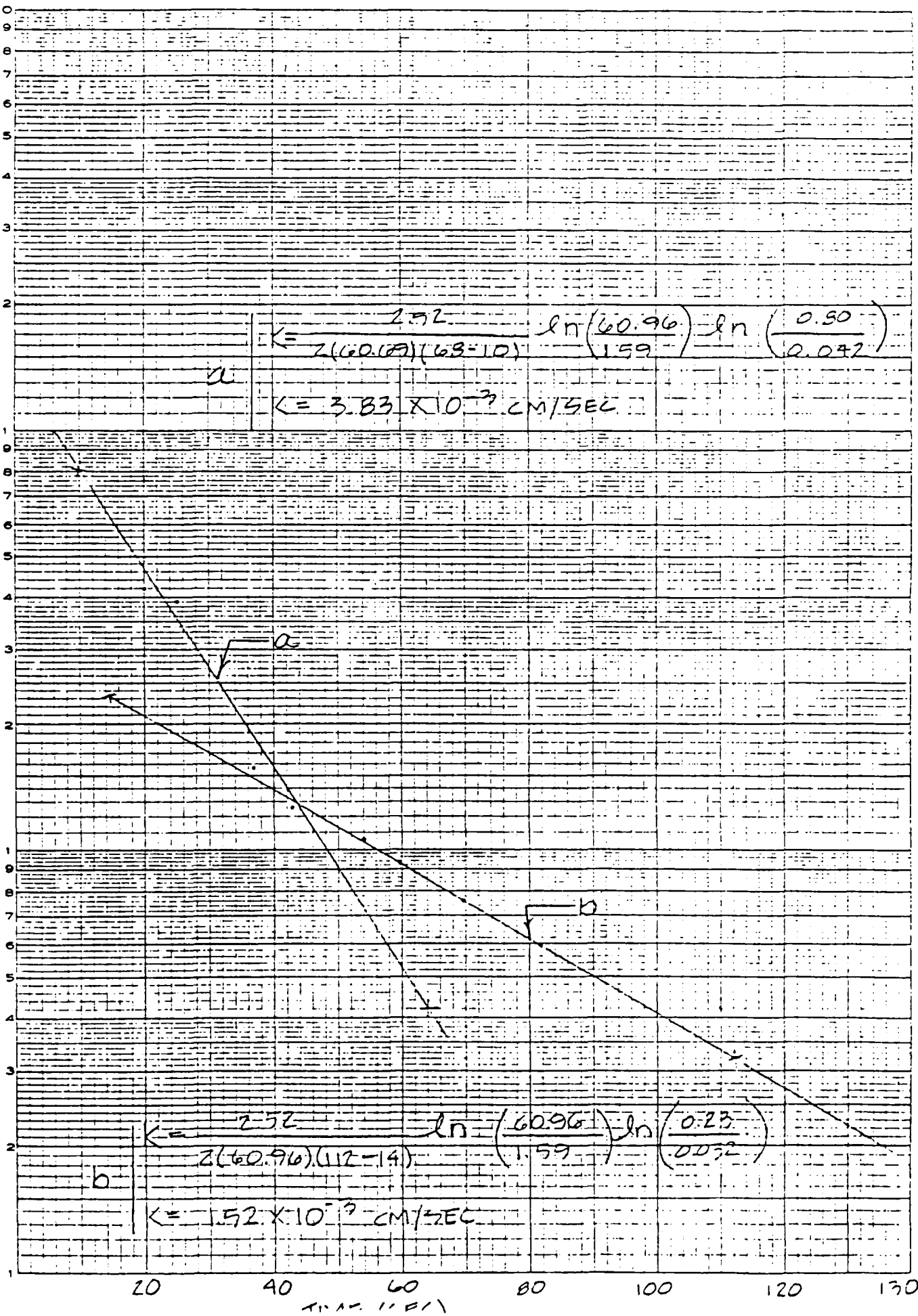
$$K = \frac{R^2}{2L(t_2 - t_1)} \ln\left(\frac{L}{R}\right) \ln\left(\frac{H_1}{H_2}\right)$$

WELL # 40

DIETARY CONCENTRATION

NO. 1000 (GEN. PH. 1000)  
SEMI-LUI  
3 CYCLES X 100.  
ONS PER INCH

$H_t/H_0$



# BAILDOWN TEST - FIELD FORM

1) Project: Hydrogeologic Investigation

2) Location: Waukegan, IL; OMC Plant

3) Client: JRB & Associates

4) Job No: 8342

5) Date: 7/26/79

6) Well or Boring No: 5

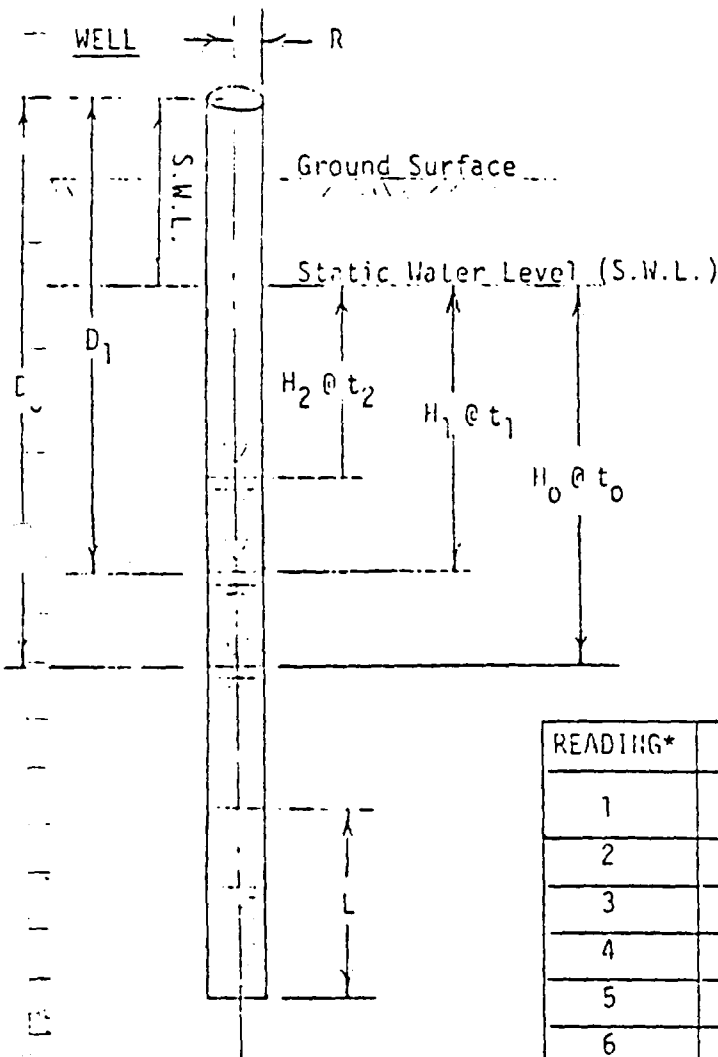
7) Personnel: Dan Hall

8) R=Radius of well= 0.625 (in.)

9) L=Length of Screen 2 (ft.)  
(from well detail sheet)

10) Static Water Level 6.65 (ft.)  
(Depth to Water)

11) Baildown Data (From Test)-Record  
Information in Minutes and Feet



READING*	TIME (Start)	DEPTH TO WATER (After Baildown) $D_t$	2+	3+
			$D_t - \text{SWL} = H_t$	$H_t/H_0$
1	$t_0$ 0	$D_0$ 6.91	$H_0$ .26	1
2	$t_1$ 10	$D_1$ .82	$H_1$ .17	.654
3	$t_2$ 20	$D_2$ .78	$H_2$ .13	.500
4	$t_3$ 27	$D_3$ .74	$H_3$ .09	.346
5	$t_4$ 40	$D_4$ .70	$H_4$ .05	.192
6	$t_5$ 55	$D_5$ .68	$H_5$ .03	.115
7	$t_6$ 72	$D_6$ .66	$H_6$ .01	.038
8	$t_7$ 90	$D_7$ .65	$H_7$ 0	0
9	$t_8$	$D_8$	$H_8$	
10	$t_9$	$D_9$	$H_9$	
11	$t_{10}$	$D_{10}$	$H_{10}$	
12	$t_{11}$	$D_{11}$	$H_{11}$	
13	$t_{12}$	$D_{12}$	$H_{12}$	
14	$t_{13}$	$D_{13}$	$H_{13}$	

\* Take readings until well is stabilized, if tight soils - test may be stopped prior to stabilization as necessary

+Disregard Columns 2 and 3 during baildown test. They are for office calculations.

$$K = \frac{R^2}{2L(t_2 - t_1)} \ln\left(\frac{L}{R}\right) \ln\left(\frac{H_1}{H_2}\right)$$

WELL #5

$$K = \frac{252}{2(152.4)(26-B)} \ln \left( \frac{152.4}{1.5R} \right) \ln \left( \frac{8}{0.96} \right)$$

$$K = 1.73 \times 10^{-3} \text{ CM/SEC}$$

$H_t/H_0$

10 20 30 40 50 60  
TIME (LF1.)

NO. 100-1310 DIETZGEN GRAPH PAPER  
SEN. 100% LINEARITY  
3 CYCLES X 10 C. 100 LINES PER INCH

DIETZGEN CORPORATION

# BAILDOWN TEST - FILLED FORM

1) Project: Hydrogeologic Investigation

2) Location: Waukegan IL; OMC Plant

4) Job No: 8342

3) Client: JRB & Associates

5) Date: 7/26/79

6) Well or Boring No: 6

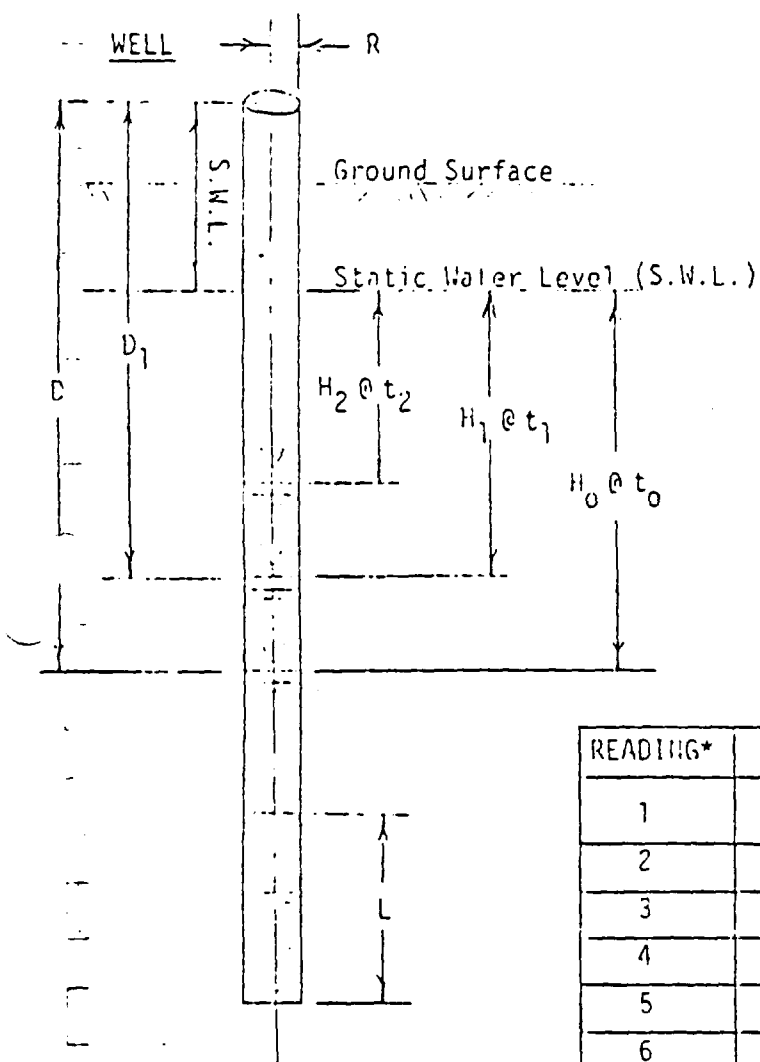
7) Personnel: Dan Hall

8) R=Radius of well= 0.625 (in.)

9) L=Length of Screen 2 (ft.)  
(from well detail sheet)

10) Static Water Level 7.22 (ft.)  
(Depth to Water)

11) Baildown Data (From Test)-Record  
Information in Minutes and Feet



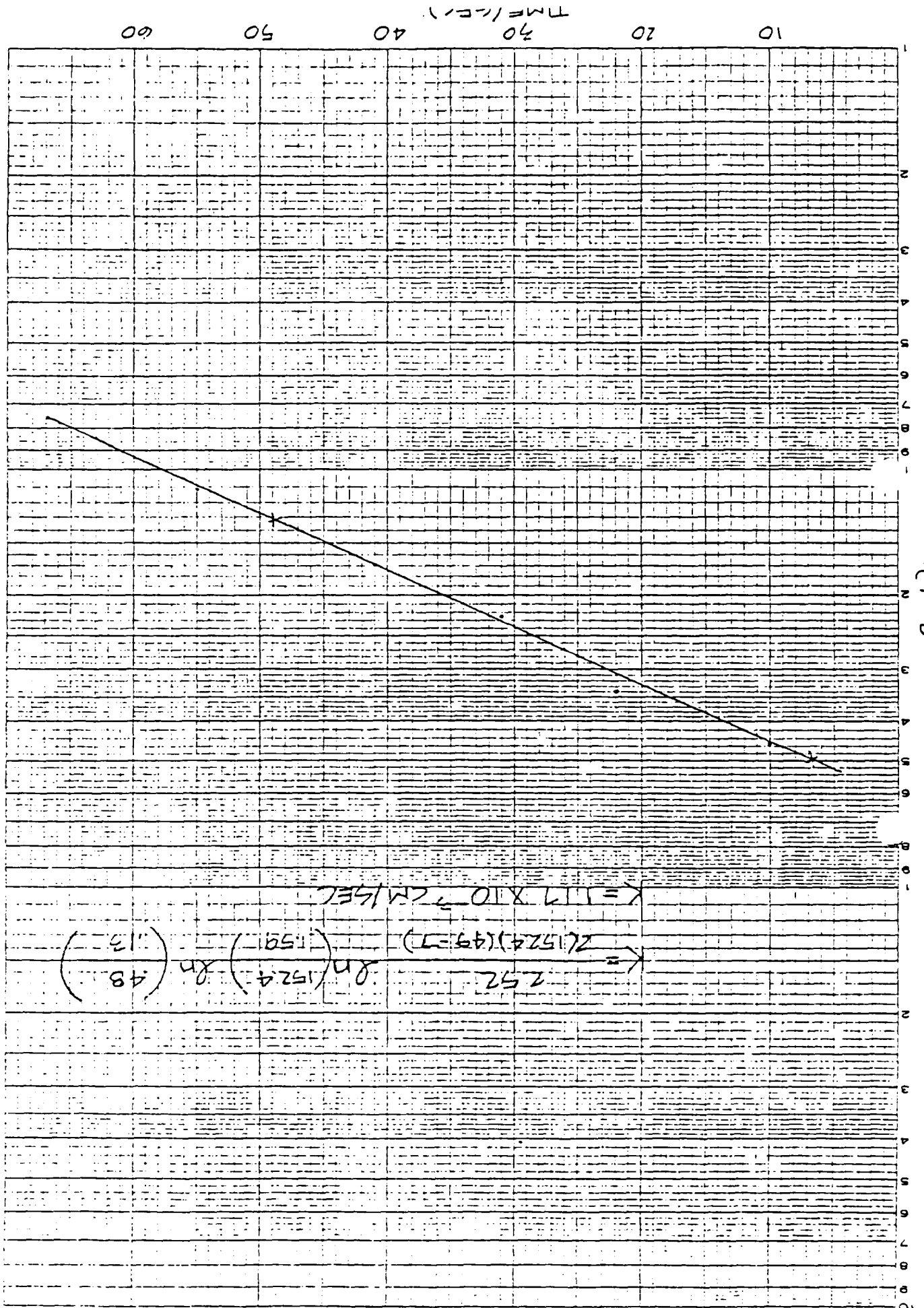
READING*	TIME (Start)	DEPTH TO WATER (After Baildown) $D_t$	DEPTH TO WATER	
			$D_t - S.W.L. = H_t$	$H_t/H_0$
1	$t_0$ 0	$D_0$ 7.40	$H_0$ .18	1
2	$t_1$ 10	$D_1$ 7.30	$H_1$ .08	.444
3	$t_2$ 22	$D_2$ 7.28	$H_2$ .06	.333
4	$t_3$ 31	$D_3$ 7.26	$H_3$ .04	.222
5	$t_4$ 41	$D_4$ 7.25	$H_4$ .03	.167
6	$t_5$ 55	$D_5$ 7.24	$H_5$ .02	.111
7	$t_6$ 65	$D_6$ 7.23	$H_6$ .01	.056
8	$t_7$ 80	$D_7$ 7.22	$H_7$ 0	0
9	$t_8$	$D_8$	$H_8$	
10	$t_9$	$D_9$	$H_9$	
11	$t_{10}$	$D_{10}$	$H_{10}$	
12	$t_{11}$	$D_{11}$	$H_{11}$	
13	$t_{12}$	$D_{12}$	$H_{12}$	
14	$t_{13}$	$D_{13}$	$H_{13}$	

\* Take readings until well is stabilized, if tight soils - test may be stopped prior to stabilization as necessary

+Disregard Columns 2 and 3 during baildown test. They are for office calculations.

$$K = \frac{R^2}{2L(t_2 - t_1)} \ln\left(\frac{L}{R}\right) \ln\left(\frac{H_1}{H_2}\right)$$

WELL 6



# BAILODOWN TEST - FIELD FORM

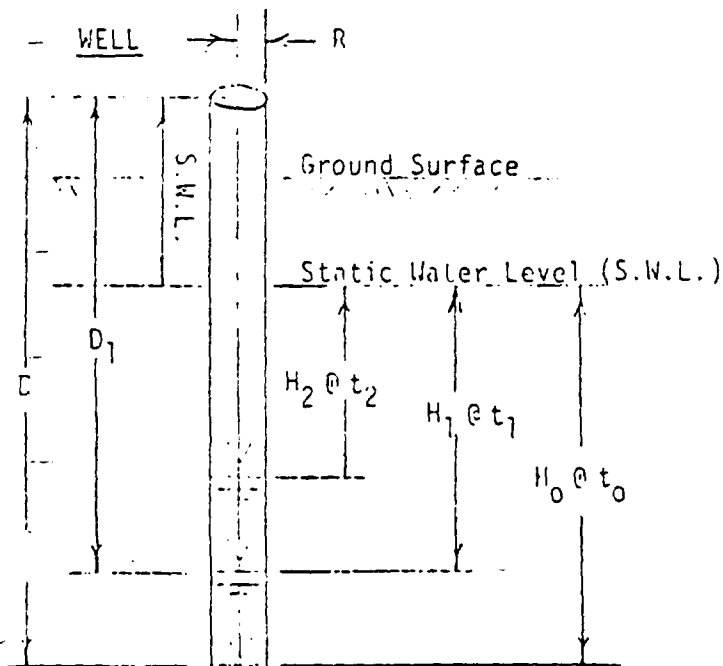
1) Project: Hydrogeologic Investigation  
 2) Location: Waukegan - OMC Plant  
 3) Client: JRB & Associates

4) Job No: 8342

5) Date: 7/27-79

6) Well or Boring No: 7A

7) Personnel: Dan Hall



8) R=Radius of well= 0.625 (in.)

9) L=Length of Screen 5 (ft.)  
 (from well detail sheet)

10) Static Water Level 5.78 (ft.)  
 (Depth to Water)

11) Baildown Data (From Test)-Record  
 Information in Minutes and Feet

READING*	TIME (Start)	DEPTH TO WATER (After Baildown) $D_t$	<u>2</u> <sup>†</sup>	<u>3</u> <sup>†</sup>
			$D_t - S.W.L. = H_t$	$H_t/H_0$
1	$t_0$	$D_0$ 5.80	$H_0$	
2	$t_1$ 40	$D_1$ 5.79	$H_1$	
3	$t_2$ NO TEST	$D_2$	$H_2$	
4	$t_3$ RECHARGED	$D_3$	$H_3$	
5	$t_4$ TOO QUICKLY	$D_4$	$H_4$	
6	$t_5$	$D_5$	$H_5$	
7	$t_6$	$D_6$	$H_6$	
8	$t_7$	$D_7$	$H_7$	
9	$t_8$	$D_8$	$H_8$	
10	$t_9$	$D_9$	$H_9$	
11	$t_{10}$	$D_{10}$	$H_{10}$	
12	$t_{11}$	$D_{11}$	$H_{11}$	
13	$t_{12}$	$D_{12}$	$H_{12}$	
14	$t_{13}$	$D_{13}$	$H_{13}$	

\* Take readings until well is stabilized, if tight soils - test may be stopped prior to stabilization as necessary

<sup>†</sup> Disregard Columns 2 and 3 during baildown test. They are for office calculations.

$$K = \frac{R^2}{2L(t_2 - t_1)} \ln\left(\frac{L}{R}\right) \ln\left(\frac{H_1}{H_2}\right)$$

BAILDOWN TEST - FIELD FORM

1) Project: Hydrogeologic Investigation

2) Location: Waukegan - OMC Plant

4) Job No: 8342

3) Client: JRB & Associates

5) Date: 7/27/79

6) Well or Boring No: 7B

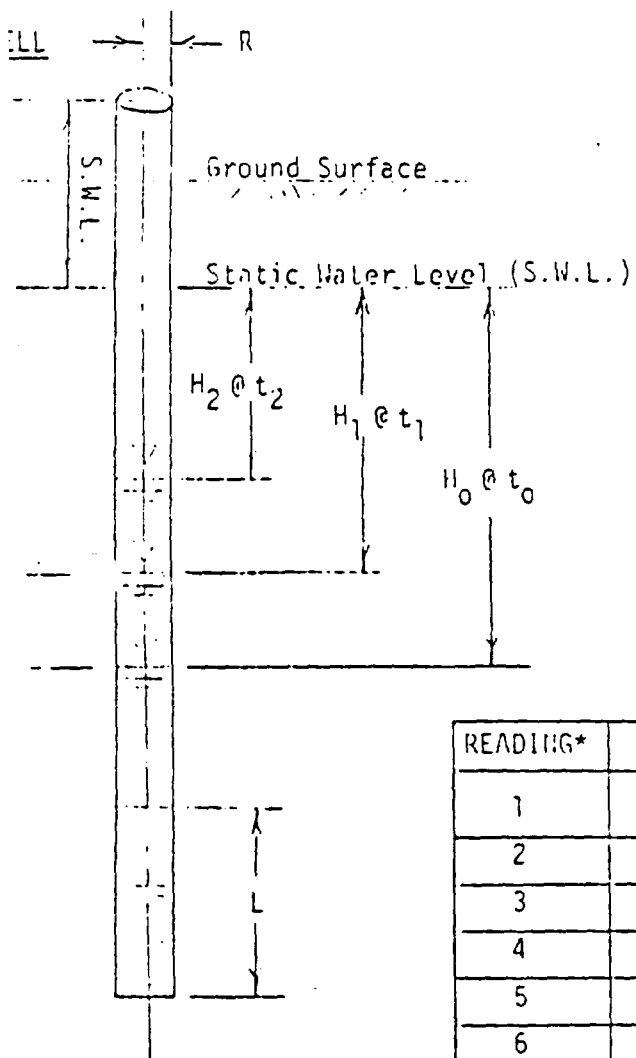
7) Personnel: Dan Hall

8) R=Radius of well= 0.625 (in.)

9) L=Length of Screen 2 (ft.)  
(from well detail sheet)

10) Static Water Level 6.04 (ft.)  
(Depth to Water)

11) Baildown Data (From Test)-Record  
Information in Minutes and Feet



READING*	TIME (Start)	DEPTH TO WATER (After Baildown) $D_t$	$\frac{2+}{D_t - S.W.L. = H_t}$	$\frac{3+}{H_t/H_0}$
1	$t_0$ 0	$D_0$ 6.8	$H_0$ .76	1
2	$t_1$ 10	$D_1$ 6.30	$H_1$ .26	.342
3	$t_2$ 16	$D_2$ 6.24	$H_2$ .20	.263
4	$t_3$ 35	$D_3$ 6.14	$H_3$ .10	.132
5	$t_4$ 45	$D_4$ 6.12	$H_4$ .08	.105
6	$t_5$ 60	$D_5$ 6.10	$H_5$ .06	.079
7	$t_6$ 86	$D_6$ 6.10	$H_6$ .06	.079
8	$t_7$ 150	$D_7$ 6.09	$H_7$ .05	.066
9	$t_8$ 205	$D_8$ 6.08	$H_8$ .04	.053
10	$t_9$	$D_9$	$H_9$	
11	$t_{10}$	$D_{10}$	$H_{10}$	
12	$t_{11}$	$D_{11}$	$H_{11}$	
13	$t_{12}$	$D_{12}$	$H_{12}$	
14	$t_{13}$	$D_{13}$	$H_{13}$	

\* Take readings until well is stabilized, if tight soils - test may be stopped prior to stabilization as necessary

+Disregard Columns 2 and 3 during baildown test. They are for office calculations.

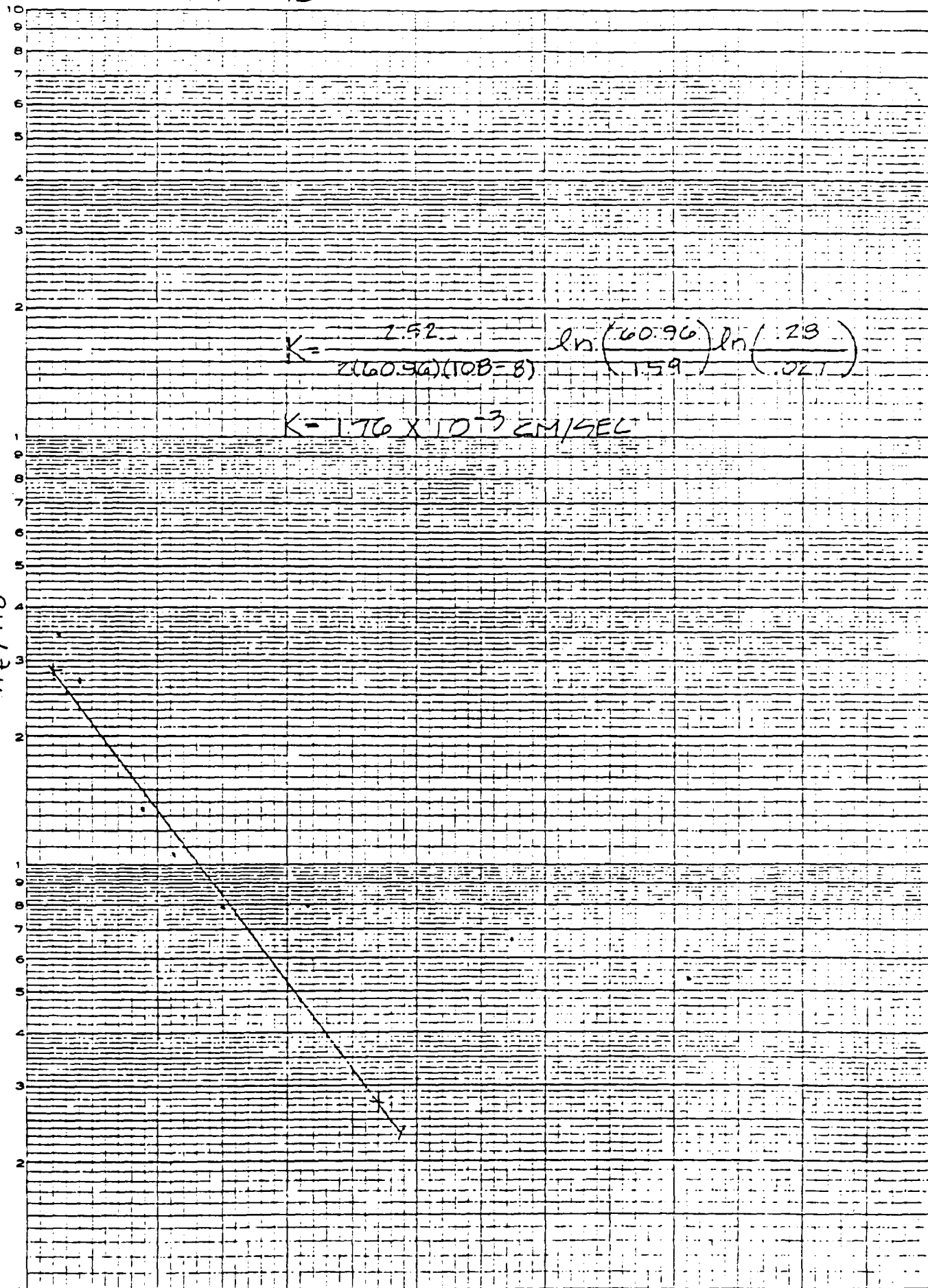
$$K = \frac{R^2}{2L(t_2 - t_1)} \ln\left(\frac{L}{R}\right) \ln\left(\frac{H_1}{H_2}\right)$$

WELL #13

DITZIG CORPORATION

NO. 100-1311 IN GRAPH PAPER  
SE. GARI C.  
3 CYCLES X 10 DIVISIONS PER INCH

$H_t/H_0$



TIME (SEC)

# BAILDOWN TEST - FIELD FORM

1) Project: Hydrogeologic Investigation

2) Location: Waukegan IL; OMC Plant

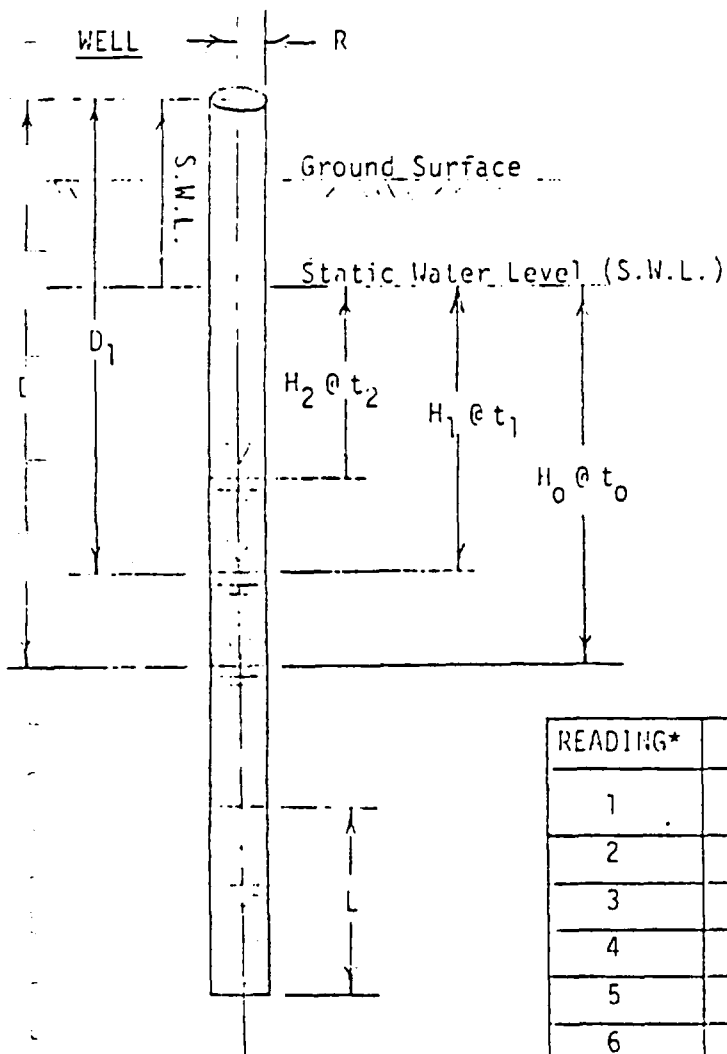
4) Job No: 8342

3) Client: JRB & Associates

5) Date: 7/27/79

6) Well or Boring No: 7C

7) Personnel: Dan Hall



8) R=Radius of well= 0.625 (in.)

9) L=Length of Screen 2 (ft.)  
(from well detail sheet)

10) Static Water Level 6.9 (ft.)  
(Depth to Water)

11) Baildown Data (From Test)-Record  
Information in Minutes and Feet

READING*	TIME (Start)	DEPTH TO WATER (After Baildown) D <sub>t</sub>	2+ D <sub>t</sub> - SWL = H <sub>t</sub>	3+ H <sub>t</sub> /H <sub>0</sub>
1	t <sub>0</sub>	D <sub>0</sub> 7.1	H <sub>0</sub> .71	1
2	t <sub>1</sub> 10	D <sub>1</sub> 6.70	H <sub>1</sub> .31	.437
3	t <sub>2</sub> 17	D <sub>2</sub> 6.55	H <sub>2</sub> .16	.225
4	t <sub>3</sub> 26	D <sub>3</sub> 6.45	H <sub>3</sub> .06	.085
5	t <sub>4</sub> 38	D <sub>4</sub> 6.41	H <sub>4</sub> .02	.028
6	t <sub>5</sub> 50	D <sub>5</sub> 6.39	H <sub>5</sub> 0	0
7	t <sub>6</sub>	D <sub>6</sub>	H <sub>6</sub>	
8	t <sub>7</sub>	D <sub>7</sub>	H <sub>7</sub>	
9	t <sub>8</sub>	D <sub>8</sub>	H <sub>8</sub>	
10	t <sub>9</sub>	D <sub>9</sub>	H <sub>9</sub>	
11	t <sub>10</sub>	D <sub>10</sub>	H <sub>10</sub>	
12	t <sub>11</sub>	D <sub>11</sub>	H <sub>11</sub>	
13	t <sub>12</sub>	D <sub>12</sub>	H <sub>12</sub>	
14	t <sub>13</sub>	D <sub>13</sub>	H <sub>13</sub>	

\* Take readings until well is stabilized, if tight soils - test may be stopped prior to stabilization as necessary

+Disregard Columns 2 and 3 during baildown test. They are for office calculations.

$$K = \frac{R^2}{2L(t_2 - t_1)} \ln\left(\frac{L}{R}\right) \ln\left(\frac{H_1}{H_2}\right)$$

WELL #7C

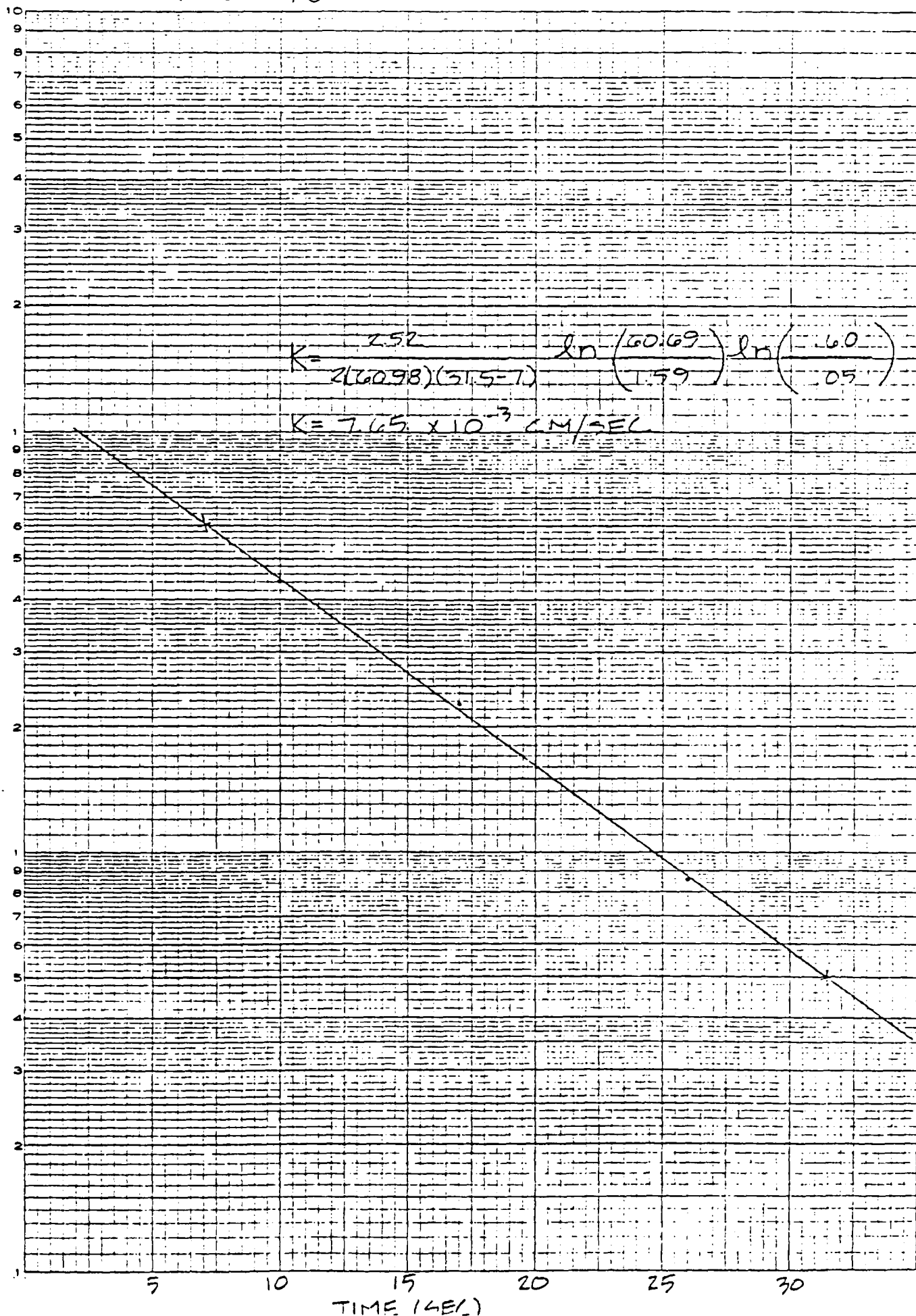
CONCENTRATION

DENSITY

GRAPH PAPER

SEMI-LOGARITHMIC  
3 CYCLES X 10 DIVISIONS PER INCH

$H_t/H_0$



TIME (SEC)

# BAILDOWN TEST - FIELD FORM

1) Project: Hydrogeologic Investigation

2) Location: Waukegan, IL: OMC Plant

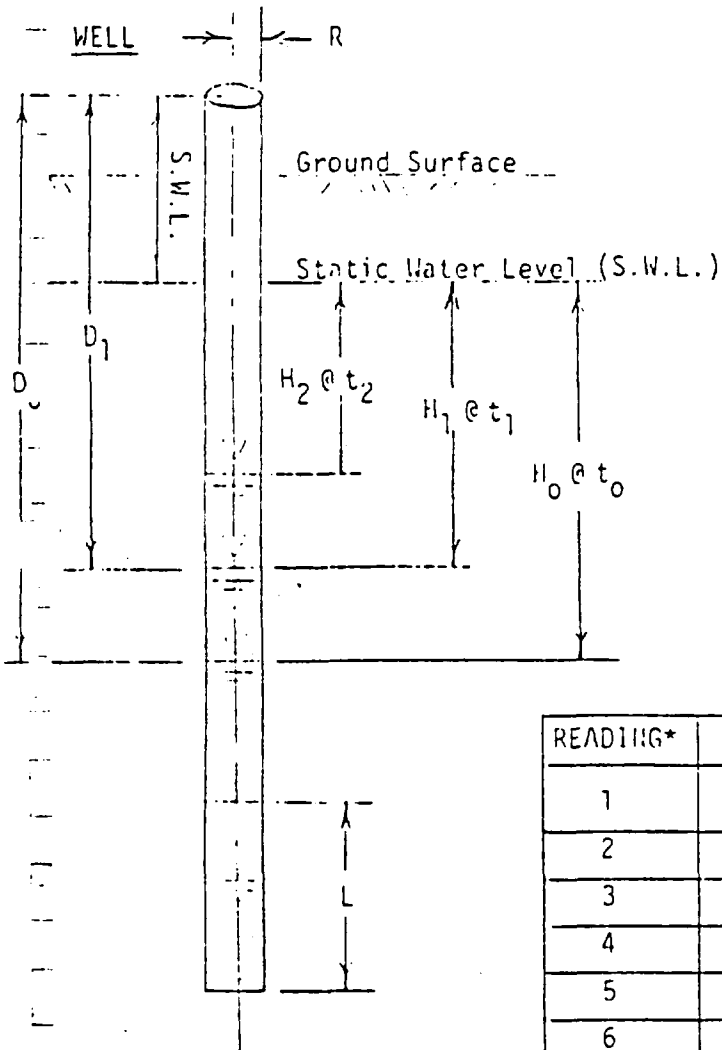
4) Job No: 8342

3) Client: JRB & Associates

5) Date: 7/19/79

6) Well or Boring No: 8

7) Personnel: Dan Hall



8) R=Radius of well= 0.625 (in.)

9) L=Length of Screen 5 (ft.)  
(from well detail sheet)

10) Static Water Level 6.88 (ft.)  
(Depth to Water)

11) Baildown Data (From Test)-Record  
Information in Minutes and Feet

READING*	TIME (Start)	DEPTH TO WATER (After Baildown) $D_t$	2+	3+
			$D_t - S.W.L. = H_t$	$H_t/H_0$
1	$t_0$	$D_0$ 7.16	$H_0$ .28	1
2	$t_1$ 25	$D_1$ 7.06	$H_1$ .18	.643
3	$t_2$ 42	$D_2$ 7.00	$H_2$ .12	.429
4	$t_3$ 57	$D_3$ 6.95	$H_3$ .07	.250
5	$t_4$ 100	$D_4$ 6.92	$H_4$ .04	.143
6	$t_5$ 135	$D_5$ 6.91	$H_5$ .03	.107
7	$t_6$ 165	$D_6$ 6.90	$H_6$ .02	.071
8	$t_7$ 240	$D_7$ 6.89	$H_7$ .01	.036
9	$t_8$	$D_8$	$H_8$	
10	$t_9$	$D_9$	$H_9$	
11	$t_{10}$	$D_{10}$	$H_{10}$	
12	$t_{11}$	$D_{11}$	$H_{11}$	
13	$t_{12}$	$D_{12}$	$H_{12}$	
14	$t_{13}$	$D_{13}$	$H_{13}$	

\* Take readings until well is stabilized, if tight soils - test may be stopped prior to stabilization as necessary

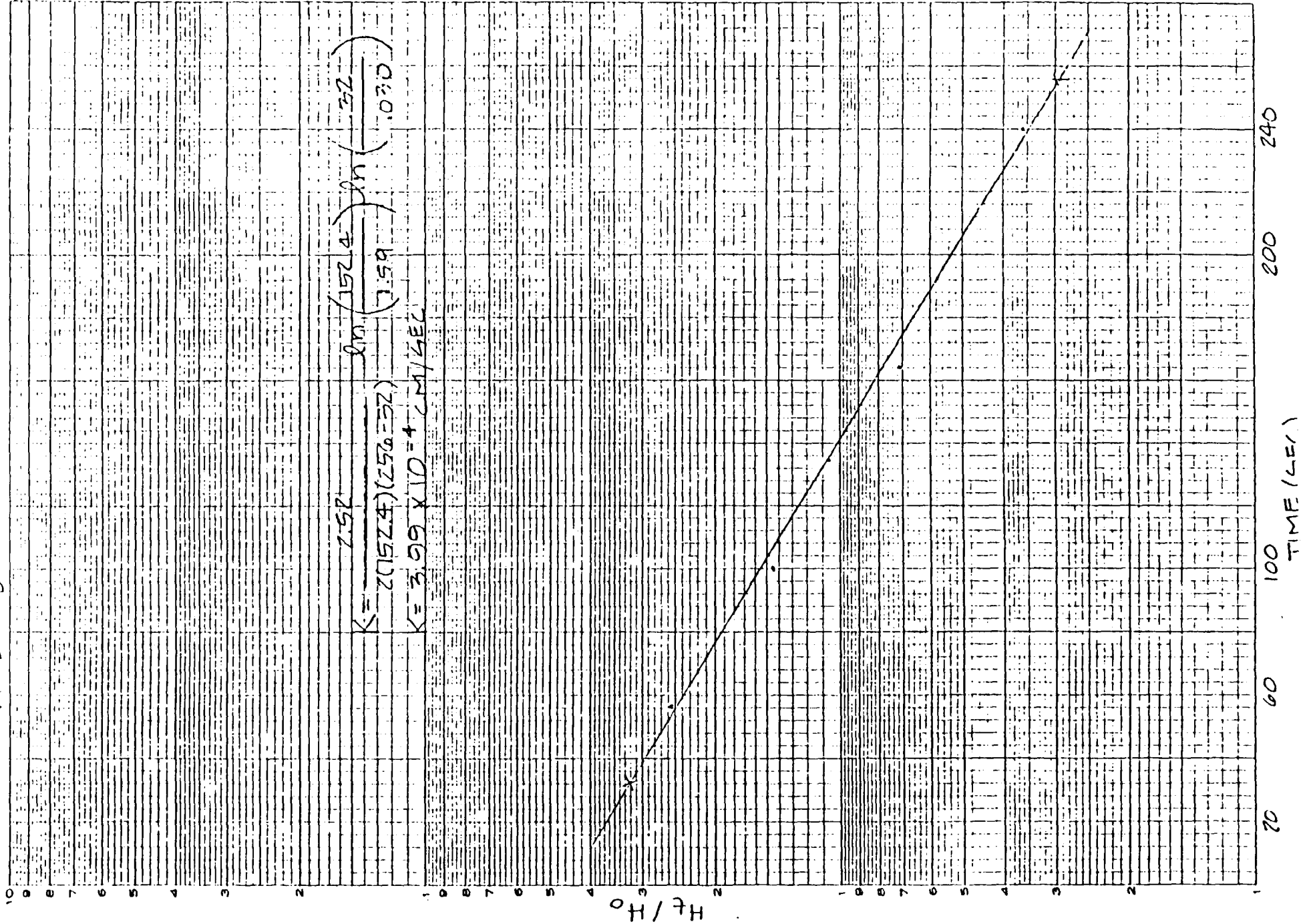
+Disregard Columns 2 and 3 during baildown test. They are for office calculations.

$$K = \frac{R^2}{2L(t_2 - t_1)} \ln\left(\frac{L}{R}\right) \ln\left(\frac{H_1}{H_2}\right)$$

WELL 9

$$K = \frac{1.52}{2(152.4)(252.57)} \ln \left( \frac{152.4}{7.59} \right) \ln \left( \frac{252.57}{103.0} \right)$$

$$K = 3.99 \times 10^{-4} \text{ CM/SEC}$$



CORPORATION

DIETZ

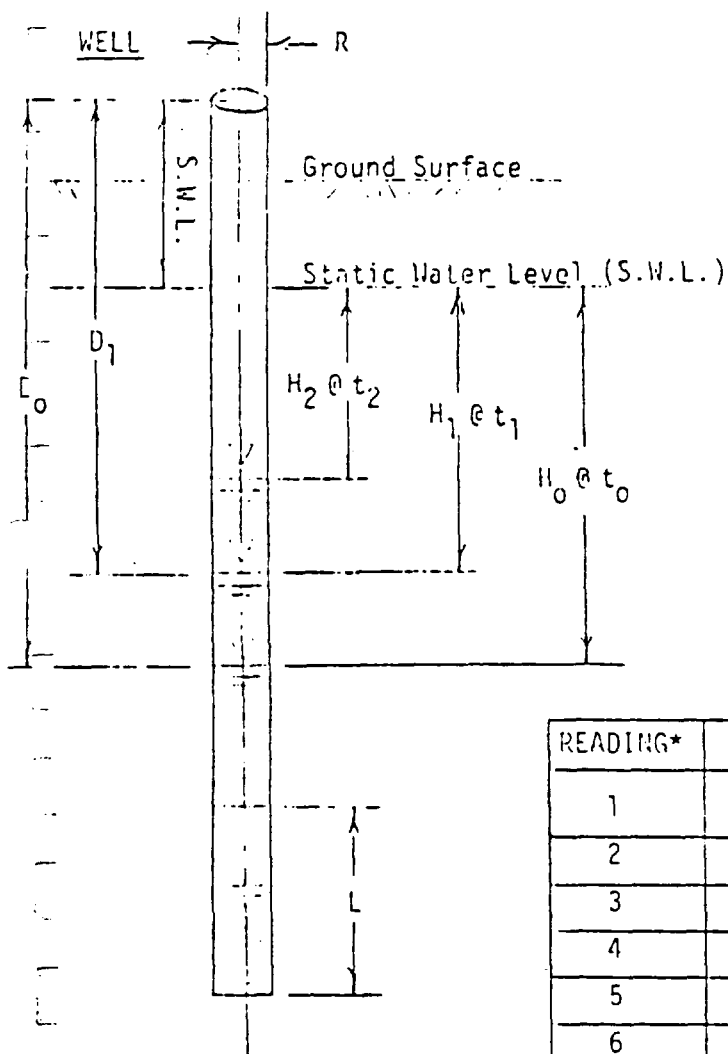
100% GRAPH PAPER

3 CYCLES X 10 DIVISIONS PER INCH

# BAILDOWN TEST - FIELD FORM

- 1) Project: Hydrogeologic Investigation
- 2) Location: Waukegan, IL; OMC Plant
- 3) Client: JRB & Associates
- 4) Job No: 8342
- 5) Date: 7/18/79

- 6) Well or Boring No: 9
- 7) Personnel: Dan Hall



- 8) R=Radius of well= 0.625 (in.)
- 9) L=Length of Screen 5 (ft.)  
(from well detail sheet)
- 10) Static Water Level 6.00 (ft.)  
(Depth to Water)
- 11) Baildown Data (From Test)-Record  
Information in Minutes and Feet

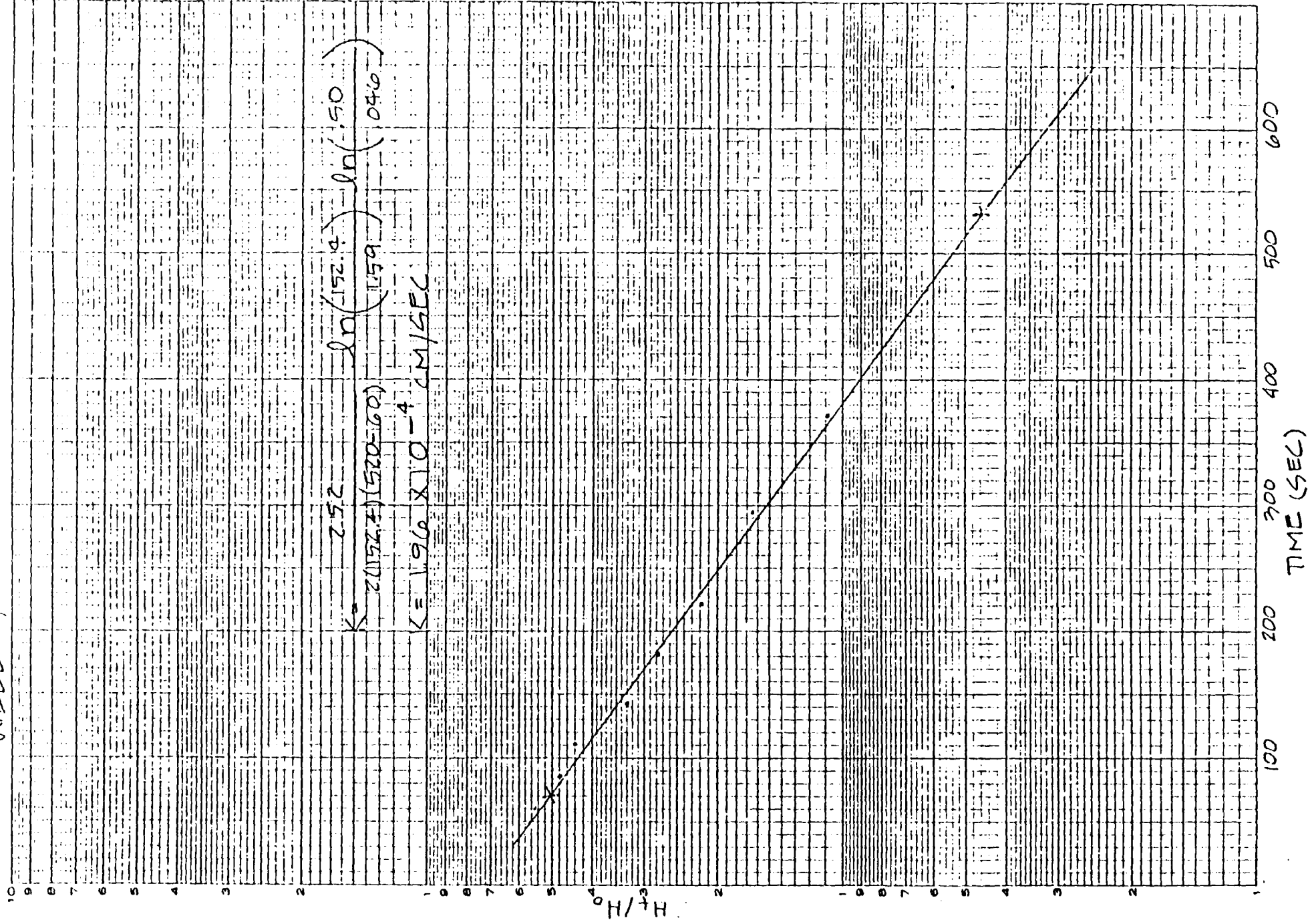
READING*	TIME (Start)	DEPTH TO WATER (After Baildown) $D_t$	2+	
			$D_t - S.W.L. = H_t$	$H_t/H_0$
1	$t_0$ 0	$D_0$ 6.92	$H_0$ .92	1
2	$t_1$ 50	$D_1$ 6.5	$H_1$ .50	.543
3	$t_2$ 75	$D_2$ 6.44	$H_2$ .44	.478
4	$t_3$ 100	$D_3$ 6.4	$H_3$ .40	.435
5	$t_4$ 133	$D_4$ 6.3	$H_4$ .30	.326
6	$t_5$ 171	$D_5$ 6.25	$H_5$ .25	.272
7	$t_6$ 211	$D_6$ 6.2	$H_6$ .20	.217
8	$t_7$ 285	$D_7$ 6.15	$H_7$ .15	.163
9	$t_8$ 362	$D_8$ 6.1	$H_8$ .10	.109
10	$t_9$ 625	$D_9$ 6.05	$H_9$ .05	.054
11	$t_{10}$ 925	$D_{10}$ 6.00	$H_{10}$ 0	0
12	$t_{11}$	$D_{11}$	$H_{11}$	
13	$t_{12}$	$D_{12}$	$H_{12}$	
14	$t_{13}$	$D_{13}$	$H_{13}$	

\* Take readings until well is stabilized, if tight soils - test may be stopped prior to stabilization as necessary

+Disregard Columns 2 and 3 during baildown test. They are for office calculations.

$$K = \frac{R^2}{2L(t_2 - t_1)} \ln\left(\frac{L}{R}\right) \ln\left(\frac{H_1}{H_2}\right)$$

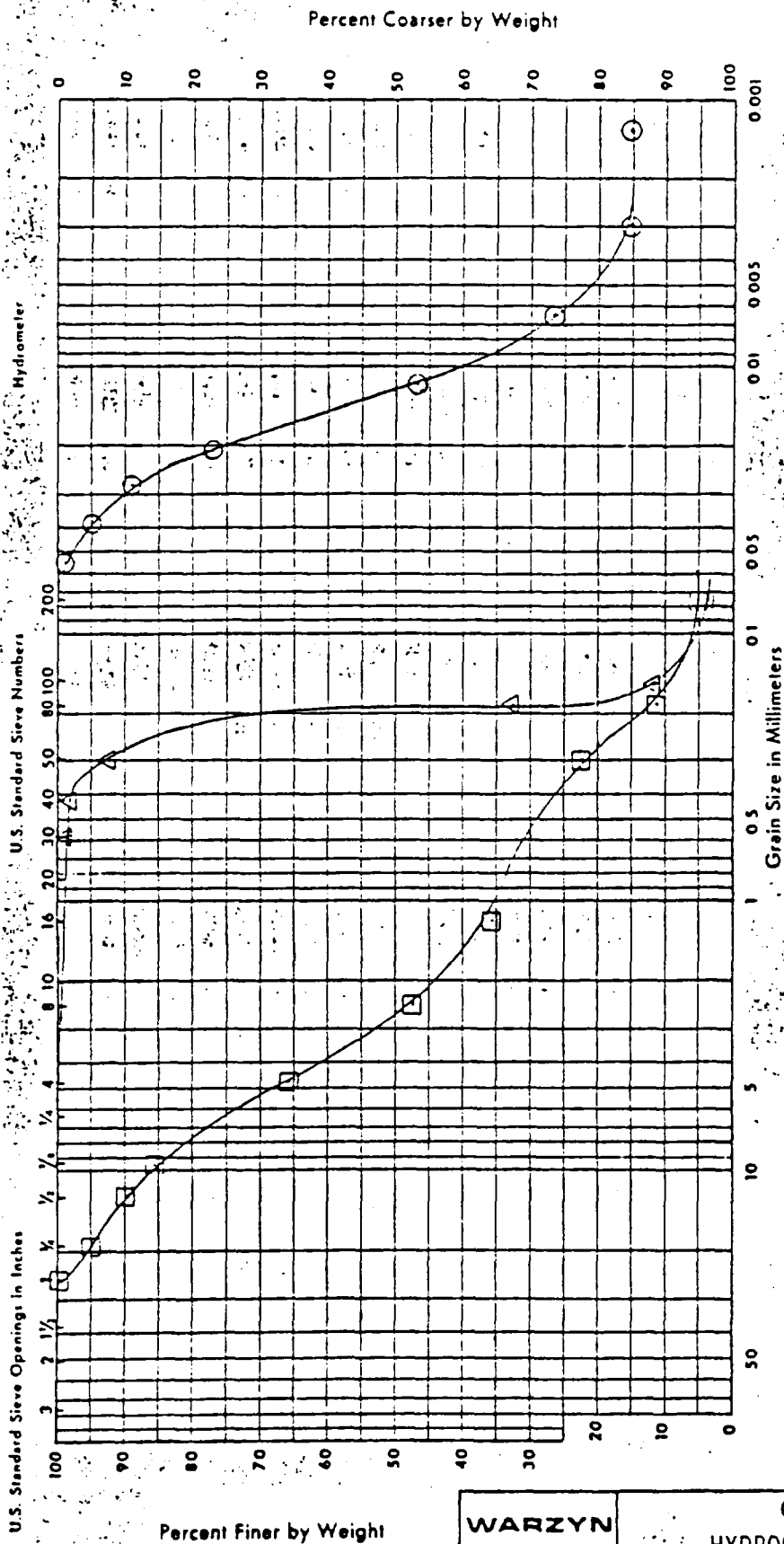
WELL 9



3 CYCLES X 10 DIVISIONS PER INCH

ALUMINUM

PER INCH



COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	SILT	CLAY
---------------	-------------	-------------	-------------	-----------	------	------

Unified Classification System (ASTM D2487)

Curve	Sample	Depth	N.M.	L.L.	P.I.	% Grav.	% Sand	% Silt	% Clay	Soil Classification
○	2C-9	35'		20.2	1.3	0	2	77	21	SILT, SOME CLAY, TRACE SAND (ML)
△	3-4	10'				0	96	4		SAND, TRACE SILT & CLAY (SP)
□	4C-2	5'				34	61	5		SAND, SOME GRAVEL, TRACE SILT & CLAY (SP-SM)



GRAIN SIZE ANALYSIS  
HYDROGEOLOGIC INVESTIGATION  
OUTBOARD MARINE CORPORATION  
WAUKEGAN, ILLINOIS

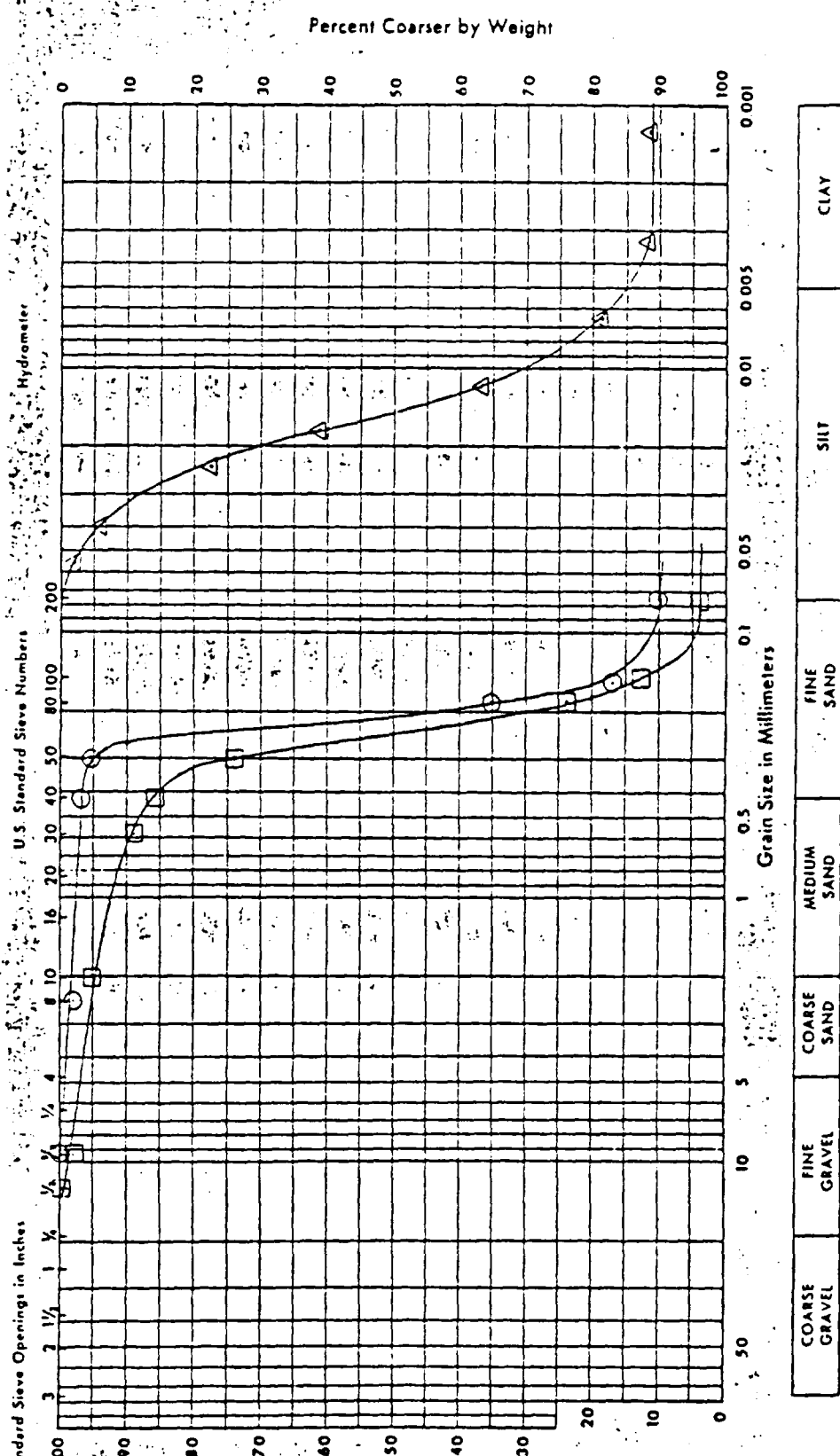
DWN RWP

CHK'D DWN

APP'D Daniel R. Viste

DATE 9/20/79

C8342-A3



Unified Classification System (ASTM D2487)

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	SILT	CLAY
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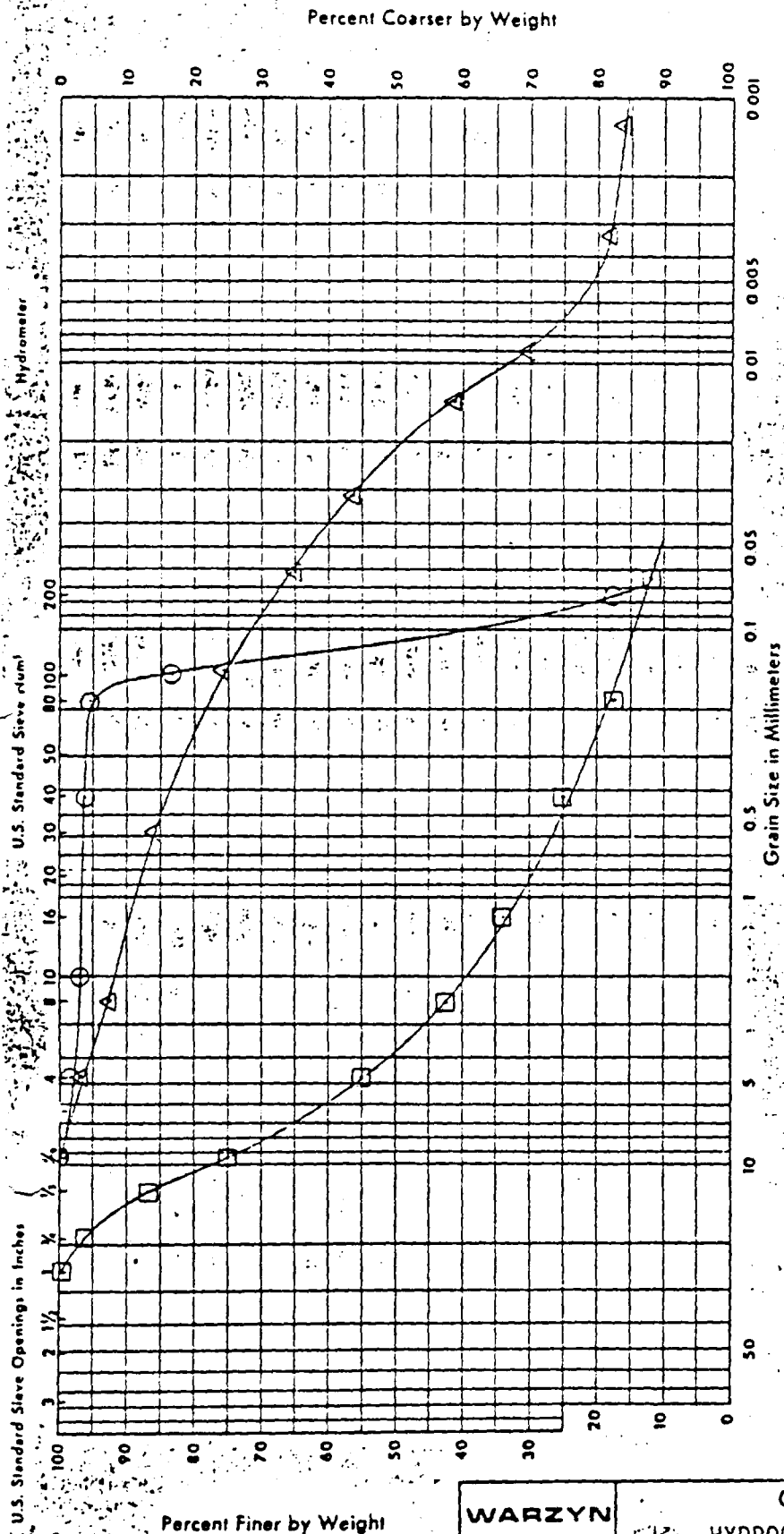
Curve	Sample	Depth	N.M.	L.L.	P.I.	% Grav	% Sand	% Silt	% Clay	Soil Classification
○	4C-5	15'				1	89	1.0		SAND, LITTLE SILT & CLAY, TRACE GRAVEL (SP-SM)
△	4C-8	30'		20.5	2.1	0	0	85	15	SILT, SOME CLAY (ML)
□	5-2	5'				2	94	4		FILL; SAND TRACE GRAVEL, TRACE SILT & CLAY (SP)



GRAIN SIZE ANALYSIS  
HYDROGEOLOGIC INVESTIGATION  
OUTBOARD MARINE CORPORATION  
WAUKEGAN, ILLINOIS

DWN	RWP	CHK'D DWH	APP'D Daniel R. Viste	DATE 9/20/79	C8342-A4
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COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	SILT	CLAY
---------------	-------------	-------------	-------------	-----------	------	------

Unified Classification System (ASTM D2487)

Curve	Sample	Depth	N.M.	L.L.	P.I.	% Grav	% Sand	% Silt	% Clay	Soil Classification
○	7C-6	20'				2	81	17		SAND, SOME SILT & CLAY, TRACE GRAVEL (SM)
△	7C-7	25'		16.3	3.7	3	25	52	20	SILT, SOME SAND & CLAY, TRACE GRAVEL (ML)
□	8-1	2.5'				45	43	12		SAND & GRAVEL, LITTLE SILT & CLAY (SW-SM)



GRAIN SIZE ANALYSIS

HYDROGEOLOGIC INVESTIGATION  
OUTBOARD MARINE CORPORATION  
WAUKEGAN, ILLINOIS

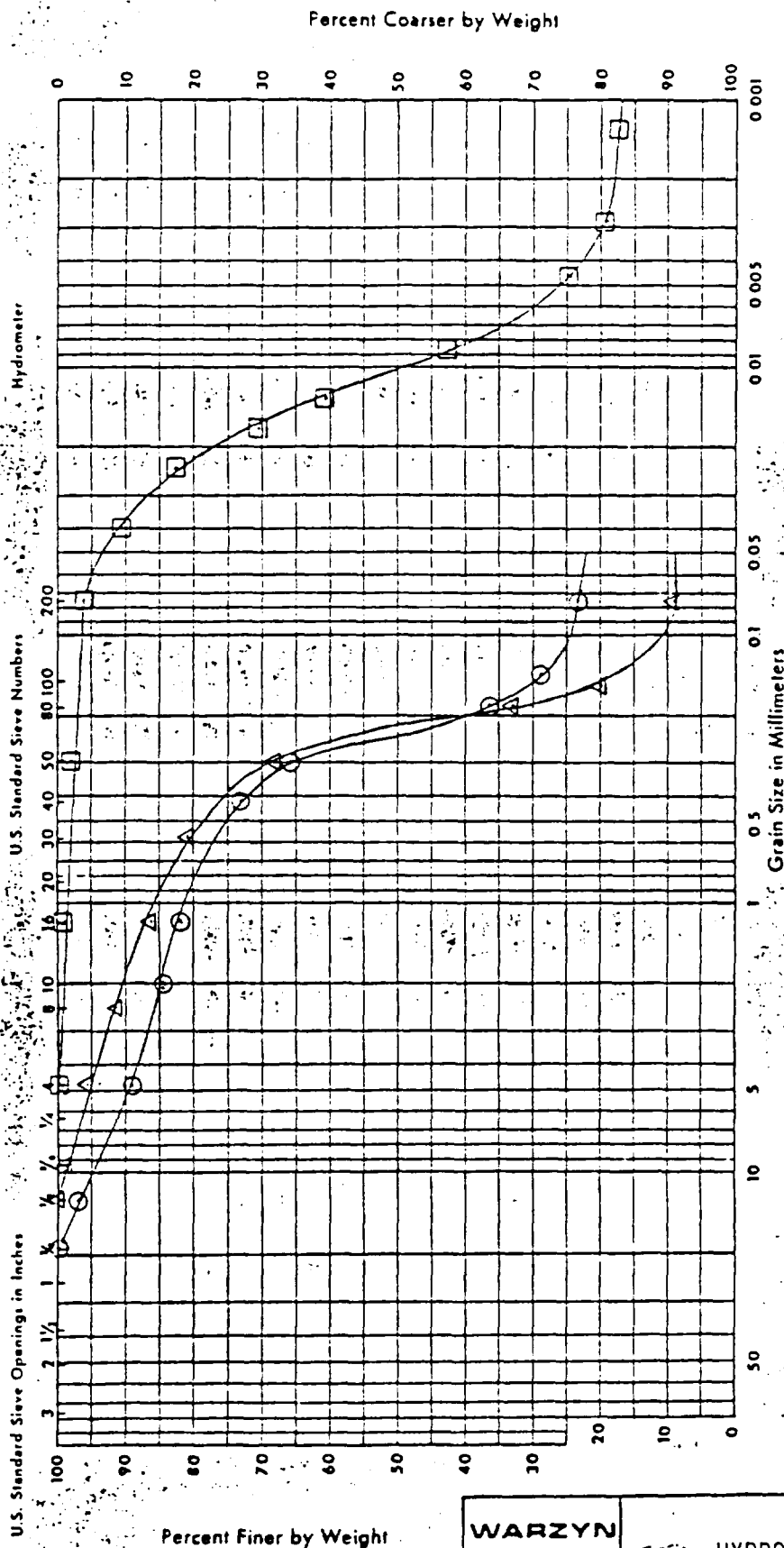
DWN RWP

CHK'D DWH

APP'D Daniel R. Vieste

DATE 9/20/79

18342-A6



COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	SILT	CLAY
---------------	-------------	-------------	-------------	-----------	------	------

Unified Classification System (ASTM D2487)

Curve	Sample	Depth	N.M.	L.L.	P.I.	% Grav	% Sand	% Silt	% Clay	Soil Classification
○	9-2	5'				11	66	23		FILL SAND, SOME SILT & CLAY, LITTLE GRAVEL (SM)
△	9-4	10'				4	87	9		SAND, LITTLE SILT & CLAY, TRACE GRAVEL (SP-SM)
□	9-8	27.5'		212	5.0	0	4	70	26	SILT, SOME CLAY, TRACE SAND (ML-CL)



GRAIN SIZE ANALYSIS  
 HYDROGEOLOGIC INVESTIGATION  
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DWN RWP

CHK'D DWH

APP'D *Daniel R. Vieta*

DATE 9/20/77 28342-A7

APPENDIX F

Photo Documentation of Methods

## LIST OF PHOTOGRAPHS

### PHOTO NO.

- 1 Wash boring hole at Well No. 9; note return water being circulated, 7-18-79.
- 2 Hosing down drill casing and drill rod prior to mobilizing to Well No. 3, 7-23-79.
- 3 Cleaning drill casing at Well No. 9 before drilling, 7-17-79.
- 4 Applying silicone grease to casing threads at Well No. 2, 7-19-79.
- 5 Cleaning split spoon with acetone at Well No. 8, 7-17-79.
- 6 Cleaning inside of well pipe with acetone soaked swab, 7-19-79.
- 7 Cleaning outside of stainless well pipe with acetone soaked cloth, 7-17-79.
- 8 Cleaning well point with acetone at Well No. 3, 7-23-79.
- 9 Cleaning protective casing with acetone for Well No. 8, 7-17-79.
- 10 Pouring in flint sand backfill around well point at Well No. 7C, 7-27-79.
- 11 Pouring in bentonite pellets at Well No. 4C for bottom seal above well screen, 7-25-79.
- 12 Bentonite powder backfill at Well No. 8, 7-17-79.
- 13 Completed Well No. 9 with concrete base around metal protective casing and locking cap.
- 14 Pumping Well No. 1; preparing for a baildown permeability test, 7-20-79.

TABLE Summary of Groundwater Elevations

Elevation of Ground Surface	Elevation of Top of Well	Elevation of Protective Casing	Well Depth	Depth to Water <sup>a</sup>	Water Elevation
584.6	586.37	587.66	8.7		
583.1	584.98	585.31	8.6		
583.2	585.83	586.00	19.9		
583.1	586.28	586.49	31.8		
589.8	593.25	593.38	11.9		
584.0	585.93	586.22	8.6		
583.9	586.80	586.74	19.6		
583.9	587.23	587.43	26.6		
585.5	586.98	588.88	9.0		
585.6	589.01	588.92	9.6		
585.0	586.92	587.45	8.6		
584.8	587.36	587.75	15.9		
584.9	587.34	588.01	22.6		
588.9	590.68	591.25	8.7		
586.3	588.21	588.84	8.6		

<sup>a</sup> Measured from Highest Point on Protective Casing or Stainless Steel Well Pipe, whichever is Higher.

All Elevations Relative to Mean Sea Level.



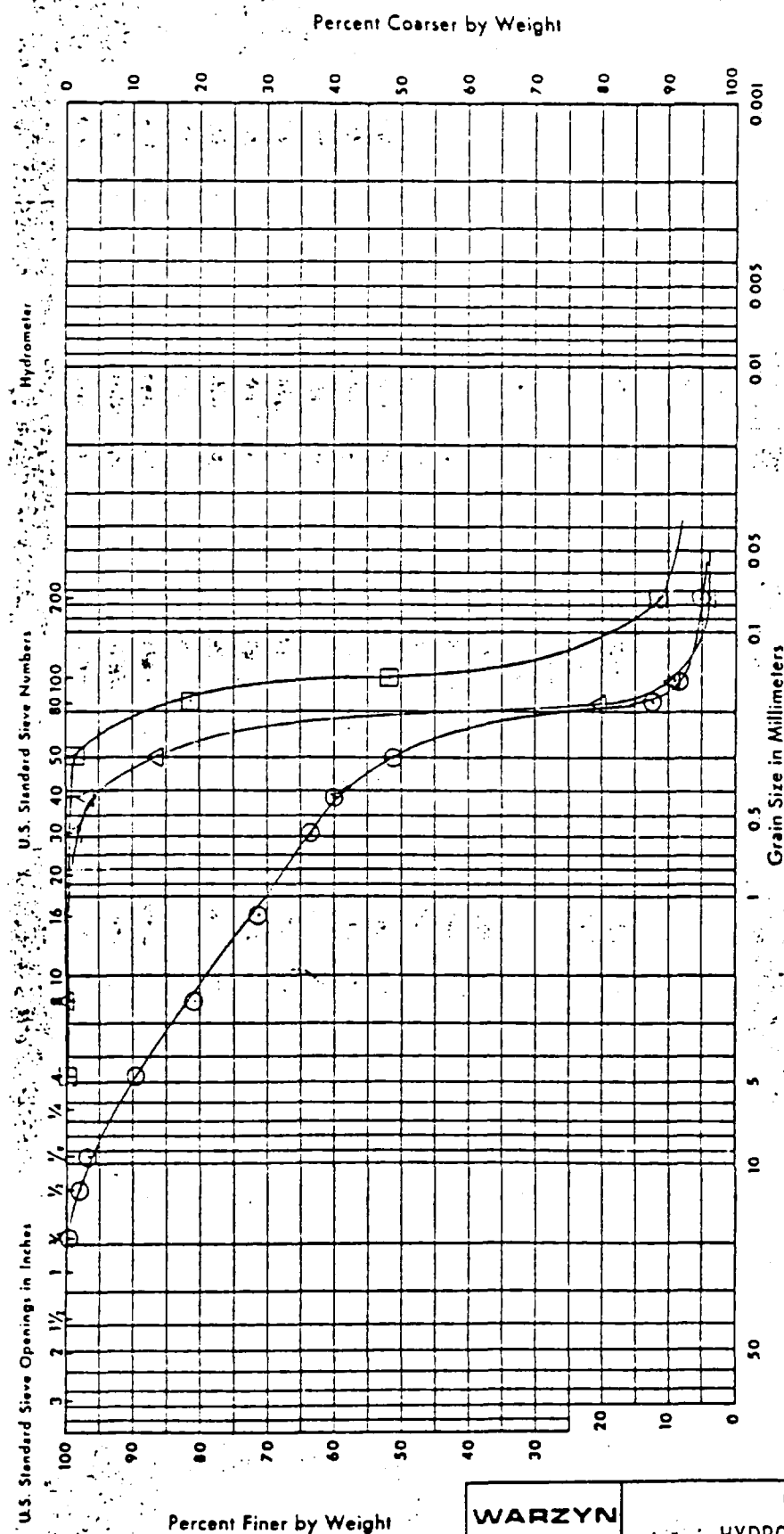
TABLE Summary of Groundwater Elevations

Well No.	Elevation of Ground Surface	Elevation of Top of Well	Elevation of Protective Casing	Well Depth	Depth to Water <sup>a</sup>	Water Elevation
1	584.6	586.37	587.66	8.7		
2A	583.1	584.98	585.31	8.6		
2B	583.2	585.83	586.00	19.9		
2C	583.1	586.28	586.49	31.8		
3	589.8	593.25	593.38	11.9		
4A	584.0	585.93	586.22	8.6		
4B	583.9	586.80	586.74	19.6		
4C	583.9	587.23	587.43	26.6		
5	585.5	586.98	588.38	9.0		
6	585.6	589.01	588.92	9.6		
7A	585.0	586.92	587.45	8.6		
7B	584.8	587.36	587.75	15.9		
7C	584.9	587.34	588.01	22.6		
8	588.9	590.68	591.25	8.7		
9	586.3	588.21	588.84	8.6		

<sup>a</sup> Measured from Highest Point on Protective Casing or Stainless Steel Well Pipe, Whichever is Higher.

NOTE: All Elevations Relative to Mean Sea Level.

APPENDIX E  
Grain Size Analysis



COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	SILT	CLAY
---------------	-------------	-------------	-------------	-----------	------	------

Unified Classification System (ASTM D2487)

Curve	Sample	Depth	N.M.	L.L.	P.I.	% Grav	% Sand	% Silt	% Clay	Soil Classification
○	1-2	5'				11	84	5		FILL, SAND, LITTLE GRAVEL, TRACE SILT & CLAY (SP-SM)
△	2C-2	5'				0	96	4		SAND, TRACE TO LITTLE GRAVEL, TRACE SILT & CLAY (SP)
□	2C-6	20'				0	89	11		SAND, LITTLE SILT & CLAY (SP-SM)



# GRAIN SIZE ANALYSIS

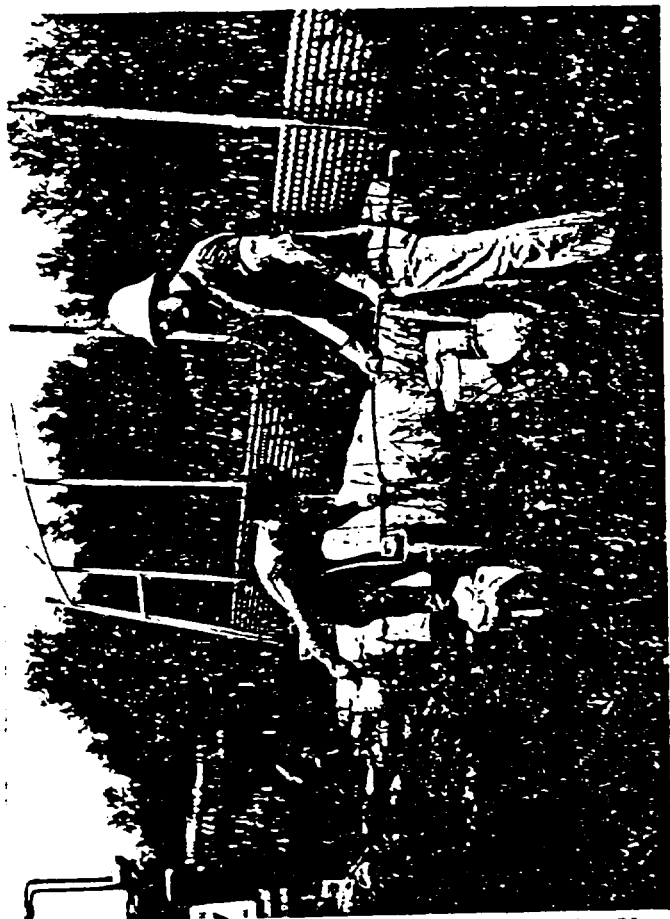
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WAUKEGAN, ILLINOIS

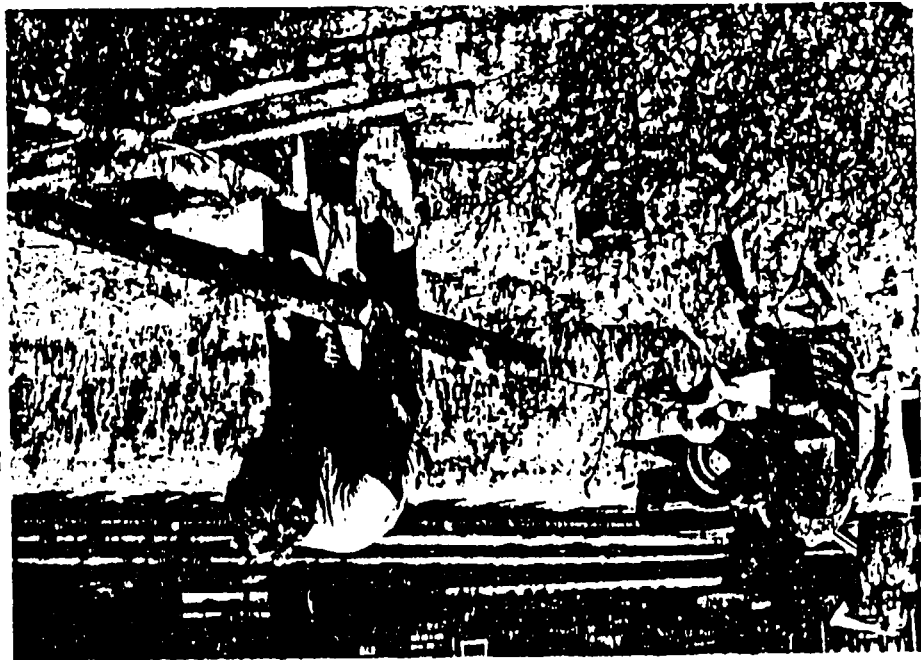
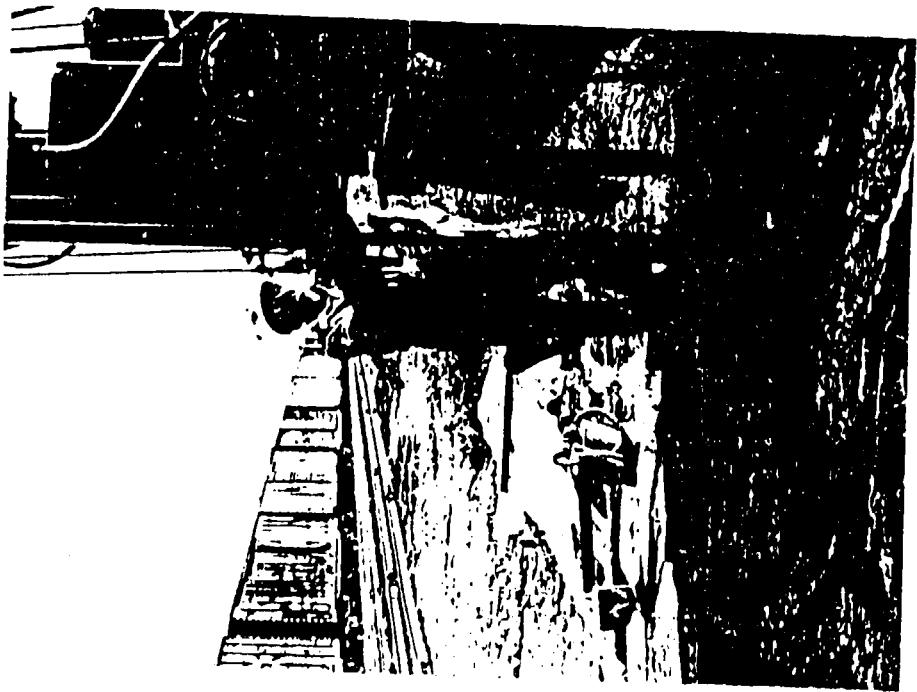
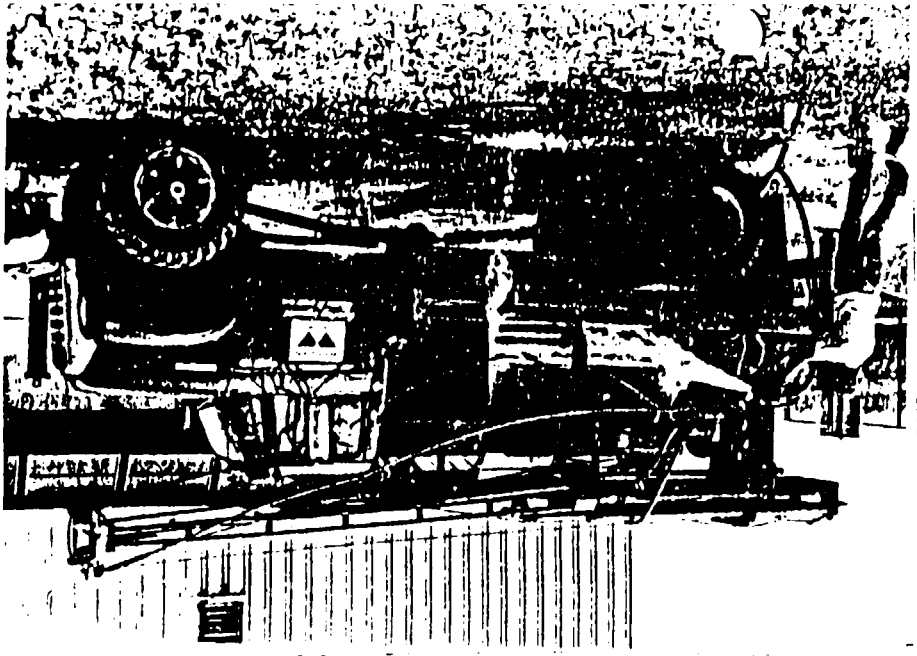
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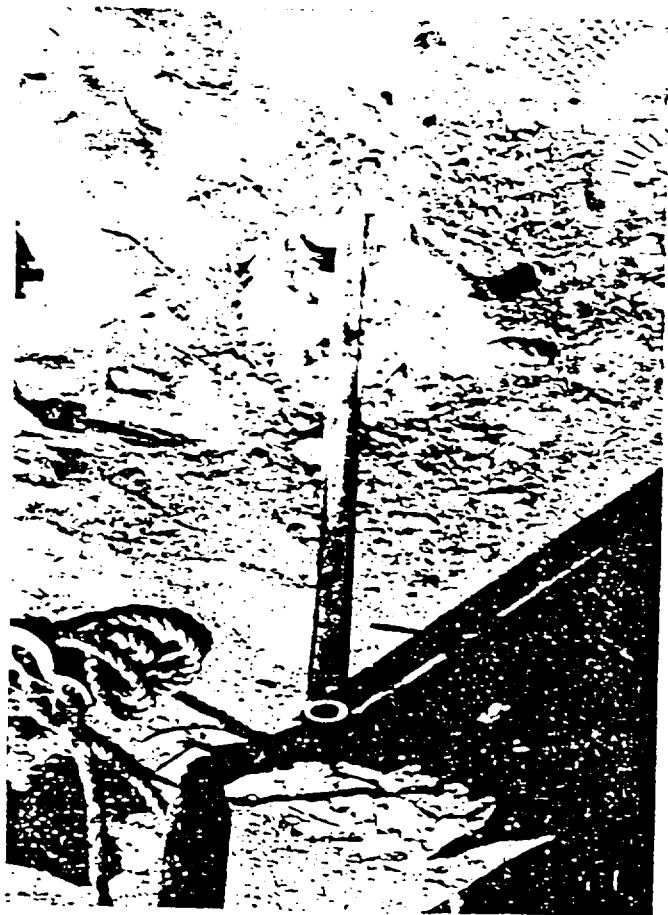
CHK'D DAH

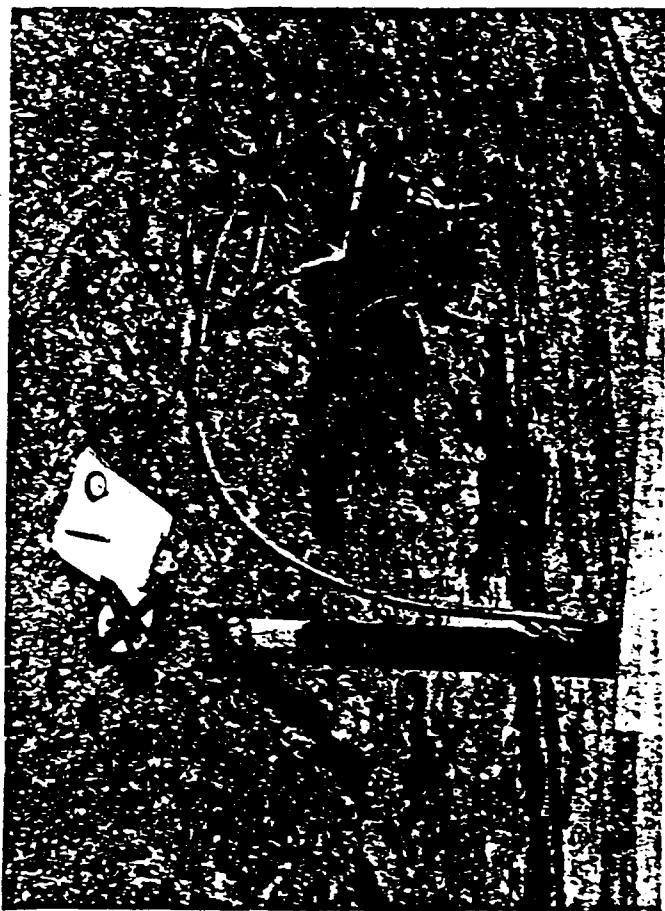
APP'D Daniel R. Vate

DATE 9/20/79 C8342-A2









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1		790196501	581.95	11.0		790197501	581.87	55.0	
2A		S02	582.28	10.2		S02	581.36	38.5	
2B		S03	582.23	24.8		S03	581.35	20.0	
2C		S04	582.28	0.5		S04	581.37	0.3	
3		S05	582.23	1.5		S05	581.30	0.5	
4A		S06	582.33	63.4		S06	581.43	45.3	
4B		S07	582.32	3.5		S07	581.42	3.2	
4C		S08	582.32	8.7		S08	581.45	2.0	
5		S09	582.20	9.53		S09	583.74	1058.6	
6		S10	582.03	6.0		S10	581.83	14.1	
7A		S11	582.37	13.240		S11	581.73	119.1	
7B		S12	582.35	35.294		S12	581.71	36.360	
7C		S13	582.34	28.58		S13	581.69	22.38	
8		S14	585.01	4.1		S14	584.68	0.7	
9		S15	583.39	2.3		S15	583.16	27.6	
		R16		1.0		R16		0.5	
		R17		0.3		R17		0.5	

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SUBJECT

FILE NO.

OMC WELL SAMPLES - WAUKEGAN

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OF

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1			582.55						
2A			581.79			7909301	582.61	22	
2B			581.83			502	581.45	4.49	
2C			581.91			503	581.44	14	
3			583.06			504	581.48	0.85	
4A			581.92			505	583.00	0.15	
4B			581.92			506	581.65	10.5	
4C			581.91			507	581.61	7.2	
5			583.46			508	581.60	29	
6			582.14			509	585.59	6.70	
7A			582.10			510	581.99	1.4	
7B			582.08			511	582.14	4900	
7C			582.08			512	582.17	34000	
8			585.64			513	582.14	17.000	
9			584.28			514	585.39	0.85	
						515	584.89	1.40	
						R16		40.05 pump	
						R16		40.05 WKR	
WELL NUMBER		SAMPLE NUMBER	WATER ELEVATION 790905	AROCLOR 1248/1242 790905 11/1		SAMPLE NUMBER	WATER ELEVATION 790911	AROCLOR 1248/1242 790911 4 1/2	
1		79094501	582.18	20		79095501	582.26	30	
2A		502	581.58	4.4		502	582.87	4.9	
2B		503	581.76	13		503	582.84	6.5	
2C		504	581.76	0.27		504	582.86	0.45	
3		505	581.89	0.11		505	582.98	0.43	
4A		506	581.82	3.2		506	582.95	6.7	
4B		507	581.90	1.7		507	582.98	2.1	
4C		508	581.79	22		508	582.94	28	
5		509	585.07	230		509	583.38	340	
6		510	582.03	1.1		510	582.55	1.1	
7A		511	582.12	2800		511	583.01	8,000	
7B		512	582.11	37000		512	582.98	35,000	
7C		513	582.04	3,400		513	583.00	3,000	
8		514	587.06	1.35		514	586.18	0.95	
9		515	585.18	4.7		515	584.03	3.8	
		R16		K 0.07		R16		0.3	
						R17		K 0.07	